GradeDec 2000 **version 2.0**

User's Manual

Federal Railroad Administration

Office of Policy and Program Development

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Introduction

Introduction to *GradeDec 2000*

GradeDec 2000 is a decision support tool that assists federal, state and local authority decision makers in evaluating the benefits and costs of highway-rail grade crossing upgrades, separations, and closures. *GradeDec 2000* employs benefit-cost methodologies that are used to evaluate highway-rail grade crossing investment alternatives at the corridor level or in a region. The modeling frameworks in *GradeDec 2000* were developed by the Federal Railroad Administration, the Volpe National Transportation Systems Center, and the National Cooperative Highway Research Program. *GradeDec 2000* analyses effectively support the planning and investment decision processes. Features of the software were designed specifically to facilitate analyses supporting Next Generation High Speed Rail and compliance with the Proposed Rule for Use of Locomotive Horns at Highway-Rail Grade Crossings 49 CFR Parts 222 and 220.

GradeDec 2000 forecasts the transportation and non-transportation effects of highway-rail grade crossing investments and estimates the economic value of these effects over the useful life of the project in dollar terms. The benefit-cost of an investment is calculated by comparing the time-stream of expected economic benefits with the time-stream of investment-related and other costs, after adjusting for the opportunity costs of capital. Known as "discounting", this adjustment enables decision makers to inspect future benefits and costs in terms of their *present-day* value. This is a standard way of giving due weight to nearer-term versus distant (thus less valued) outcomes.

GradeDec 2000's underlying methodology is consistent with the current benefit-cost methodologies employed by the United States Department of Transportation Agencies (Federal Railroad Administration, Federal Highway Administration, Federal Transit Administration, and the Federal Aviation Administration) and with Executive Order 12866, which governs the principles of federal infrastructure investment. The model is transparent in all of its assumptions and the model inputs are readily accessible to users who may want to adjust model inputs to reflect local circumstances.

GradeDec 2000 is designed to minimize the data needs and technical expertise required of the user while at the same time providing credible benefit-cost results. With information about a series of grade crossing improvements along a particular corridor, the range of anticipated accident reductions, train crossing delay improvements, and n travel demand forecasts generate preliminary benefit-cost results for a given confidence interval. Depending on the user's needs, requirements, and abilities, the user can select either an extensive default database that will minimize input requirements, or the user can customize the results by inputting project specific localized data. In this way, *GradeDec 2000* functions as both a high-level preliminary model and a micro-level localized model.

Why *GradeDec 2000*

Growing requirements for highway-rail grade crossing investments and dwindling fiscal resources point to the need for a new tool for investment analysis. *GradeDec 2000* determines the effects rail corridor investments will have on safety and highway delay and queuing. Improvements will result in the following economic benefits:

- Improvement in safety and reduced accident costs;
- Reduced travel time costs;
- Improved air quality
- Reduced vehicle operating costs; and
- Network benefits.

GradeDec 2000 uses risk analysis to evaluate highway-rail grade crossing investments and the results of an analysis include probability distributions for all of the model outcomes. These outcomes are viewed with *GradeDec 2000*'s user-friendly displays of charts and statistics.

For a corridor or regional analysis, *GradeDec 2000* can evaluate up to 600 grade crossings simultaneously. The user can view model results in total for the corridor or region, or by individual grade crossings. For example, the user can view the safety benefits of each grade crossing improvement along the corridor and the probability range associated with those benefits. Likewise, the user can view the highway vehicle operating costs savings or environmental benefits for each grade crossing.

GradeDec 2000 conducts comprehensive statistical simulations in order to provide a probability range for the net present value associated with each rail corridor-level investment plan. This enables the user to assess the risk associated with each plan. Additionally, *GradeDec 2000* conducts risk sensitivity analyses based upon the probability ranges and informs the user which factors will have the greatest impact on the outcomes. For each result the user can display a "tornado chart" that shows the ten most significant factors contributing to risk. This information is essential for planning contingencies and working to mitigate risks.

GradeDec 2000 thus provides important insight for planners and decision makers in prioritizing investment plans. Two series of investments displaying an equal net present value may not offer equal promise if one exhibits a materially greater down-side risk of a low return.

In any "portfolio" there is a place for riskier investments; the important thing is to be aware of them and to chose them judiciously. *GradeDec 2000* provides the management information needed to support decisions involving trade-offs between the expected return and the riskiness of investments.

New Features in *GradeDec 2000*

GradeDec 2000 includes a host of new features and these are listed here as interface and analytic improvements:

Interface Improvements

- The software is re-engineered entirely in Visual Basic 6.0 thus ensuring stability, Y2K compliance and compatibility with current and future versions of the Microsoft Windows™ operating system.
- The user interface is re-designed for ease of use and improved navigation and accessibility to data and assumptions.
- The user can custom tailor the data for each grade crossing and does not have to rely upon pre-defined grade crossing profiles.
- The risk analysis data input form now provides a choice of probability distributions - skewed bell-shaped, uniform, triangle or normal distribution.
- The new data input form enables immediate visualization of the data.
- There is a seamless import/export interface with spreadsheet programs.
- The years dimension for data inputs adjusts dynamically to the user's definition - there is no scrolling through screens of placeholder inputs.
- The number of results variables adjusts dynamically to the number of grade crossings in an analysis. The software can accommodate up to 600 custom grade crossings in an analysis.
- There is a new chart format - the Tornado Chart - that displays the top ten input variables to which the risk of a result is most sensitive.
- The model reports all benefit results by benefits category for every grade crossing, and, for the corridor as a whole.
- Software facilitates the direct import of data from the National Inventory of Highway-Rail Grade Crossings and certain GIS software applications.

Analytic Improvements

- The *GradeDec 2000* model includes DOT's Accident Prediction and Severity Formulas and these are be applied individually to each grade crossing and the corridor as a whole thus enabling corridor-wide analysis of predicted accidents in the base year and over the forecast horizon.

- The model also includes safety algorithms specifically designed to evaluate the safety impacts of higher speed rail.
- The model accounts for the correlation between the time-of-day distribution of traffic by rail and highway modes.
- The model re-assigns highway traffic when improvements involve closures and grade separations.
- The model calculates non-conventional, local benefits from grade crossing improvements.
- The model calculates the consumer surplus that is consistent with rigorous definitions of benefits.

Overview of the GradeDec 2000 System

The diagram below presents an overview of the *GradeDec 2000* system's main process and file structure. The system is designed for ease-of-use and conceptual clarity. The design enables novice and casual users to conduct meaningful analyses with relative ease while not requiring the user to wade through technically dense material. At the same time, expert users who want to take advantage of all of the system's features should find *GradeDec 2000* useful for the comprehensive analysis of corridor-wide and regional grade-crossing improvements.

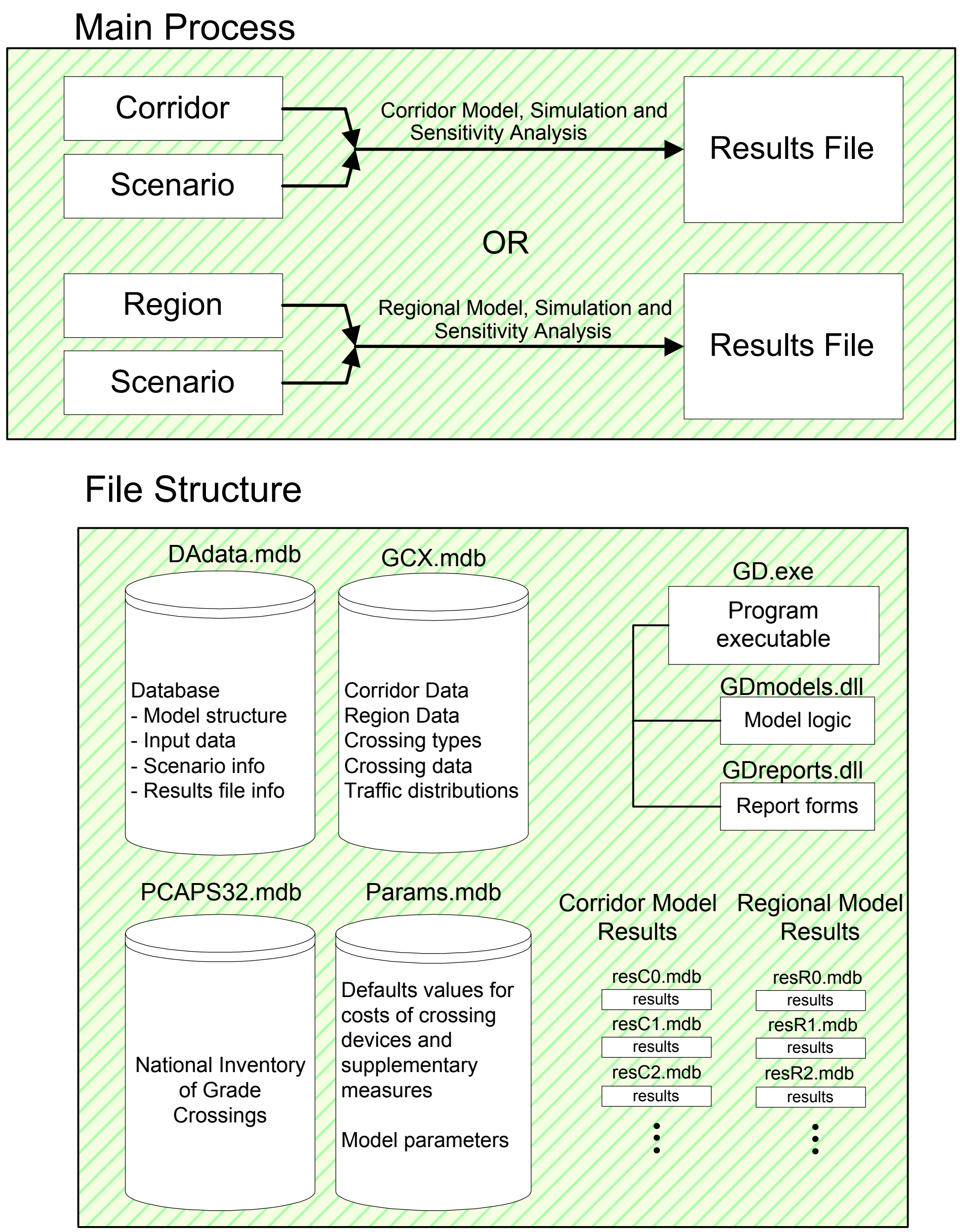

Figure 1 GradeDec 2000 Main Process and File Structure

GradeDec 2000 Objects

The functions of *GradeDec 2000* build upon several objects that are key components in every analysis. These objects are: the *GradeDec 2000* model, corridors or regions, scenarios and results files. When *GradeDec 2000* is active, the system will always specify instances of these objects in its **Current Selections** (see Main Form below).

The following subsections describe the *GradeDec 2000* objects.

The GradeDec 2000 *Models*

GradeDec 2000 contains two models: A corridor model and a regional model. The corridor model is suited for analyses of grade crossings along a single rail alignment. The regional model considers grade crossings in a region irrespective of their locations on rail corridors.

Each of the two *GradeDec 2000* models contains a defined set of input variables, result variables and the formulas and processes that generate the results. The models themselves are deterministic, that is, for a fixed set of input values they generate a fixed set of results values. The *GradeDec 2000* Reference Manual provides the documentation of the models.

The *GradeDec 2000* program contains a simulation engine that samples from probability ranges on the input values and runs the selected model many times to generate many sets of results in a simulation, thus producing a probability distribution for each of the result variables. (The process of sampling from input variable distributions to evaluate the probability distributions of result variables is referred in this manual as “risk analysis”, “simulation” or “Monte Carlo simulation”).

When running a simulation, the selected *GradeDec 2000* model is populated with data from two sources: the corridor or region, and the scenario specified in **Current Selections**. The model results are stored in the results file specified in **Current Selections**. Probability ranges can be assigned only to scenario data.

Corridors (Corridor Model Only)

A “corridor” refers to a continuous series of highway-rail grade crossings along a rail line that are the candidates for improvements or closure.

A corridor definition includes an ID number assigned by the system, a corridor name, a technology impact factor (that determines the effectiveness of new technology on predicted accidents relative to conventional lights and gates), the length of the corridor in miles, the average number of trains per day and the number of switch trains, and a date/time number indicating the last modification of crossing data or corridor definition. A corridor contains at least one grade crossing and the model can accommodate up to a maximum of 600 grade crossings per corridor. Grade crossing data include the physical characteristics of the crossing, existing and proposed crossing types, crossing accident-related data and cost data.

The corridor definitions, crossing data and the crossing type definitions are stored in a database called GCX.mdb.

Regions (Regional Model Only)

A “region” refers to a collection of highway-rail grade crossings in a region that are the candidates for improvements or closure.

A region definition includes an ID number assigned by the system, a region name, a technology impact factor (that determines the effectiveness of new technology on predicted accidents relative to conventional lights and gates), a percent representing the reduction in benefits from crossing closures, and a date/time number indicating the last modification of crossing data or region definition. A region contains at least one grade crossing and the model can accommodate up to a maximum of 600 grade crossings per region. Grade crossing data include the physical characteristics of the crossing, existing and proposed crossing types, crossing accident-related data and cost data.

The region definitions, crossing data and the crossing type definitions are stored in a database called GCX.mdb.

Note: This version of *GradeDec 2000* lets the user import data directly from FRA's National Inventory of Highway-Rail Grade Crossings database.

Scenarios

A scenario is a collection of data required for an analysis (i.e., every data element corresponds to a *GradeDec 2000* model input variable). A scenario definition includes a system assigned ID, a name, a start year, a last year of near term, an end year, and a date/time specifying the last modification of scenario data.

The data belonging to a scenario have two distinguishing features:

- Scenario data are not specific to a particular crossing or corridor (one scenario can potentially serve in the analysis of more than one corridor), and,
- The data for a model input variable in a scenario can be one of the following: 1) a fixed value, 2) two values representing the minimum and maximum points of a uniform probability distribution, 3) three values that describe a skewed bell-shape probability, 4) minimum, maximum and most likely values of a triangle distribution, or 5) the mean and standard deviation of a normal distribution for the input variable

All scenario data and definitions are stored in the DAdata.mdb database.

Results Files

The results of a risk analysis simulation and a sensitivity analysis are stored in a separate database file. The results file definition includes a system assigned ID and user-specified description. When a simulation is run, the results file definition is modified to include date/time of analysis, number of trials and random seed information.

Software Installation

Follow these instructions to install the software onto your system.

1. **Install the software**

- Insert the CD-ROM in the disk drive, or, download files from the internet to a folder on your local hard drive.
- Open Windows Explorer to the folder (on the CD-ROM or your hard drive) containing the file GD2K.exe.
- Double-click on the file GD2K.exe.
- Follow the installation instructions that appear on your screen.
- If a message appears indicating that a file can not be copied because the destination file is in use, click on the Ignore button, your computer does not need this file. Installation will proceed normally after this. (The message indicating a destination file is in use and the need to click on Ignore may occur several times during installation).
- Click OK when the installation is complete.

2. **Install a database containing data from FRA's National Inventory of Highway-Rail Grade Crossings.**

- For CD-ROM, select a region on the CD-ROM in the Regions folder and double-click on the selection.
- For web download installation, double-click on the Regionx.exe (or, National.exe) file that you downloaded.
- Follow the installation instructions that appear on your screen.

3. **You are now ready to begin using the software.**

System Requirements

The hardware and software requirements to run the software are given below.

- Intel Pentium family computer running the Windows 95/98, Windows Millenium Edition or, Windows 2000 operating systems.
- A minimum of 32 MBytes total memory.
- Hard disk space required for installation is 20 MBytes.

Software Performance and System Hardware

Systems meeting the minimum specifications should perform most functions with near-instantaneous speed. However, the speed of a simulation on minimally configured systems may be slow.

In general, systems with more memory and faster CPUs will run simulations faster. Besides hardware configuration, the time to complete a simulation will depend upon a) the number of grade crossings in a region or corridor, and, b) the number of trials in a simulation.

As a benchmark, a computer with a 350 Mhertz processor and 64 Mbyte RAM will run 500 simulations with 10 grade-crossings, including sensitivity analysis, in under 25 seconds.

Manual Overview

The remainder of this document describes the steps of a *GradeDec 2000* analysis and each of the forms that are encountered during an analysis. The manual concludes with a glossary of terms and an index.

Using *GradeDec 2000*

Introduction

There are five steps in conducting a *GradeDec 2000* analysis. These are illustrated in the following figure:

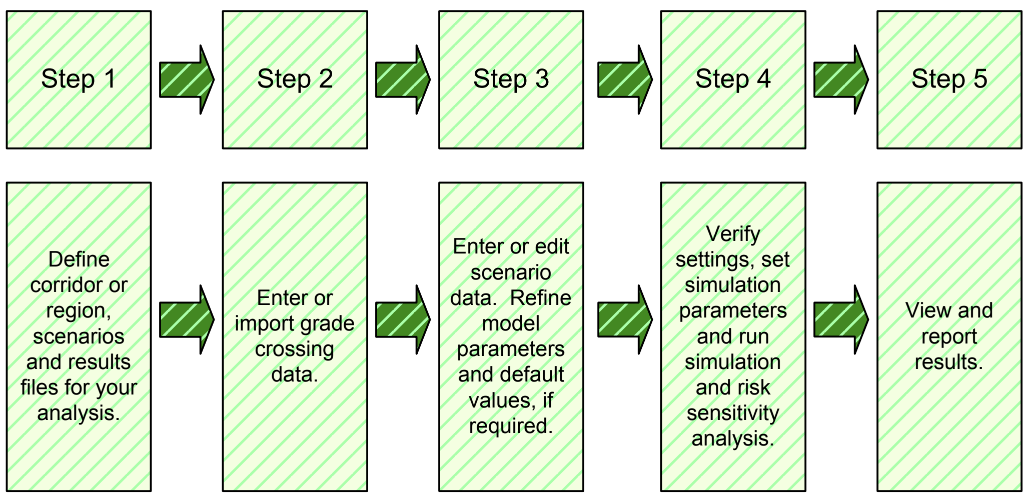

Figure 2 Steps in a GradeDec 2000 *Analysis*

The following sections will guide you through these steps.

Step 1: Define Components of Analysis

The first step of a *GradeDec 2000* analysis is to define the components of the analysis. After you define the components, you can enter data and run a simulation in the subsequent steps.

Select Model

First, you need to select either the corridor model or the regional model. The corridor model evaluates improvements along a single rail alignment and estimates impacts along the adjacent highway network. With a regional analysis, the crossings that are candidates for improvement do not need to lie on a single alignment and the model does not evaluate impacts on the adjacent highway network.

Select the model by clicking on the appropriate node of the **Object Tree** in the Main form.

Define Region or Corridor

You define a new corridor or region by selecting the menu option "Create new>Corridor (or Region)" in the Settings Form. Modify the definition of the new corridor or region using the procedure described in the section describing the Settings Form.

You can select a previously defined region or corridor by using the **Object Tree** in the Settings Form.

Define Scenario

You define a new scenario by selecting the menu option "Create new>Scenario" in the Settings Form. Modify the definition of the new scenario using the procedure described in the section describing the Settings Form.

You can select a previously defined scenario by using the **Object Tree** in the Settings Form.

Define Results File

You define a new results file by selecting the menu option "Create new>Scenario" in the Settings Form. Modify the definition of the new results file using the procedure described in the section describing the Settings Form.

You can select a previously defined results file by using the **Object Tree** in the Settings Form.

Step 2: Enter or Import Grade Crossing Data

You enter grade crossing data for a pre-defined region or corridor by invoking the Corridor Crossing Data form (Corridor Model) or the Regional Crossing Data form (Regional Model). You invoke these forms by double-clicking on the **Function Tree** of the Main Form.

You can import data to a corridor or region from the National Inventory of Highway-Rail Grade Crossings database. See the sections on the forms mentioned above for instructions on data entry and management.

The grade crossing data forms (corridor and region) have menu options that enable you to generate graphs that rank risks at crossings in the base case and the alternate case. There are also menu options for generating reports of the grade crossing data.

Step 3: Enter or Edit Scenario Data

Scenarios include data related to rail operations in the corridor or region, highway traffic, social costs and price growth rates. The Scenario Form allows for probability ranges that reflect uncertainty for each input variable. See the section on the Scenario Form for instructions.

Step 4: Verify Settings, Set Parameters and Run Simulation

Verify Settings

Verify the settings by viewing the selections in the **Current Selections** at the upper left of the Main Form. If you need to change settings, call the Settings Form by double-clicking Settings on the **Function Tree.** Select new objects by double-clicking a node of the **Object Tree** under each of the collections Corridors or Regions, Scenarios and Results files.

Set Simulation Parameters and Run Simulation

From the **Function Tree** on the Main Form, select by double-clicking on Simluation. This will invoke the Simulation Form. Set the parameters on the form and click on the Run Simulation button. For detailed instructions, see the Simulation form section.

Step 5: View and Report Results

Use the Results form and the Full-Screen Charts and Tornado Charts forms to view and report your results. These forms allow for easy navigation and printing. Results data can be exported to an Microsoft Excel spreadsheet (see the Results Form section, "Export and Print").

Forms in *GradeDec 2000*

Introduction - Key to Forms

The figure to the right shows an hierarchy of all the forms in *GradeDec 2000* and a reference number for each form. The reference number indicates a section providing complete instructions for the form.

The remainder of this chapter contains a section for each form describing the form, its purpose and function, and the data elements associated with it.

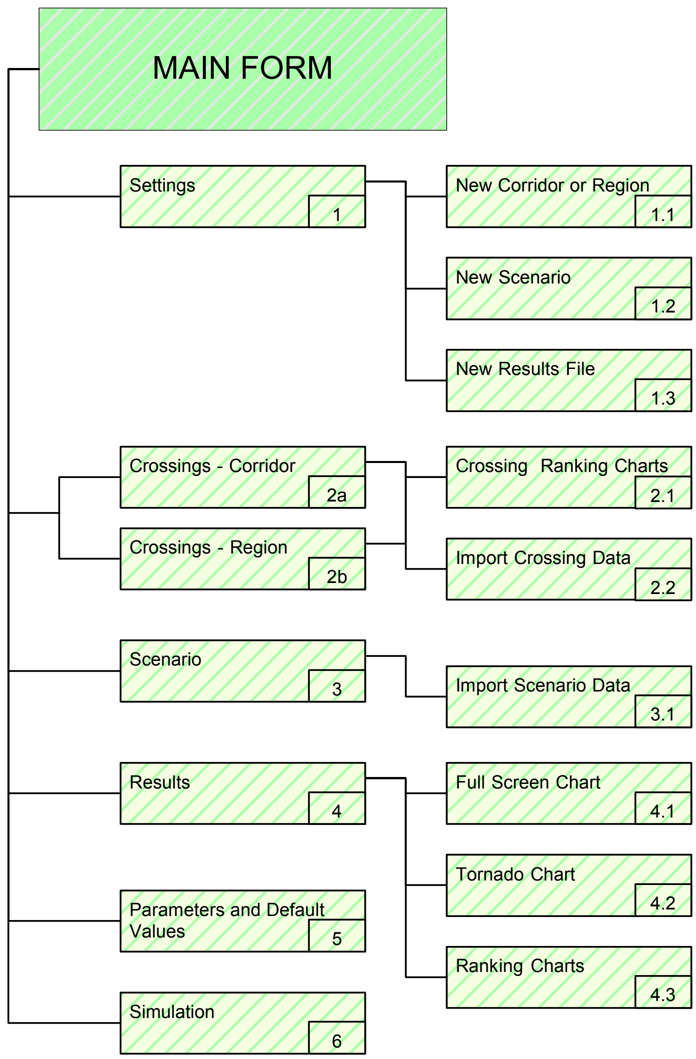

Figure 3 Key to Forms

The Main Form

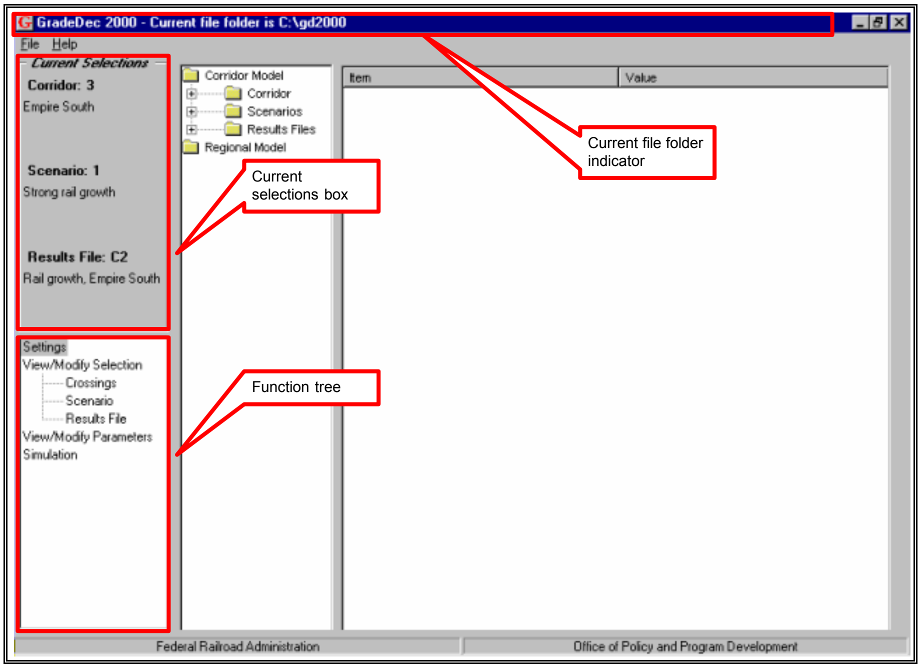

Figure 4 Main Form with Fixed Elements Outlined and Annotated

Description

The Main Form is the "parent" form of *GradeDec 2000* (i.e., it is an always-visible background and container for the other forms. The Main Form has three principal elements, namely:

1) **Current Selections** (upper left of form), 2) the **Function Tree** (lower left), 3) the Current file folder indicator (top row of form).

Embeded in the Main Form is the Active Child Form that appears on the right side and includes its own menu at the top of the form . The three elements of the Main Form are fixed and always visible when running *GradeDec 2000.* The active child form and the menu vary depending upon the function selected in the **Function Tree** (and, by additional selections made from within several of the child forms).

How you invoke this form

The **Main Form** appears after starting *GradeDec 2000* by clicking on the icon in the Windows Start menu. It is always visible when *GradeDec 2000* is running.

Exit *GradeDec 2000* by pressing the "X" box in the upper-right hand corner of the main form.

Fixed Elements of the Main Form

Current File Folder Indicator

The caption line at the top of the form displays the current file folder that *GradeDec 2000* is using. The current file folder can be modified from the menu in the Settings Form.

Current Selections

The **Current Selections** are the settings that will be used for viewing/modifying selections and running simulations.

Three components make up the current selections: corridor or region, scenario and results file. To change the current selections use the **Settings Form**.

On startup, the **Current Selections** are the default settings.

There are two sets of default settings in *GradeDec 2000*: One for the corridor model and one for the regional model. Upon start up, *GradeDec 2000* shows the default settings for the default model (either corridor or region).

To select the current file folder or the settings, and to restore or save defaults use the **Settings Form**.

The Function Tree

The function tree enables navigation among the different forms and functions of *GradeDec 2000*. By double-clicking on a node in the function tree, the user invokes the different forms corresponding to the selected function. The following forms are invoked when you double-click on a node of the **Function Tree.**

- Settings - the **Settings Form**
- View/Modify Selection

  Crossings – the **Corridor Crossings Form** or, the **Regional Crossings Form** (depending upon whether the corridor model or the regional model is selected).

  Scenario – the **Scenario Form**

  Results File – the **Results File Form**
- View/Modify Parameters – the **Parameters and Default Values Form**
- Simulation – the **Simulation Form**

Data Elements

The Main Form is a container for all of the other forms. The sections describing the other forms discuss their data elements.

Settings Form (1)

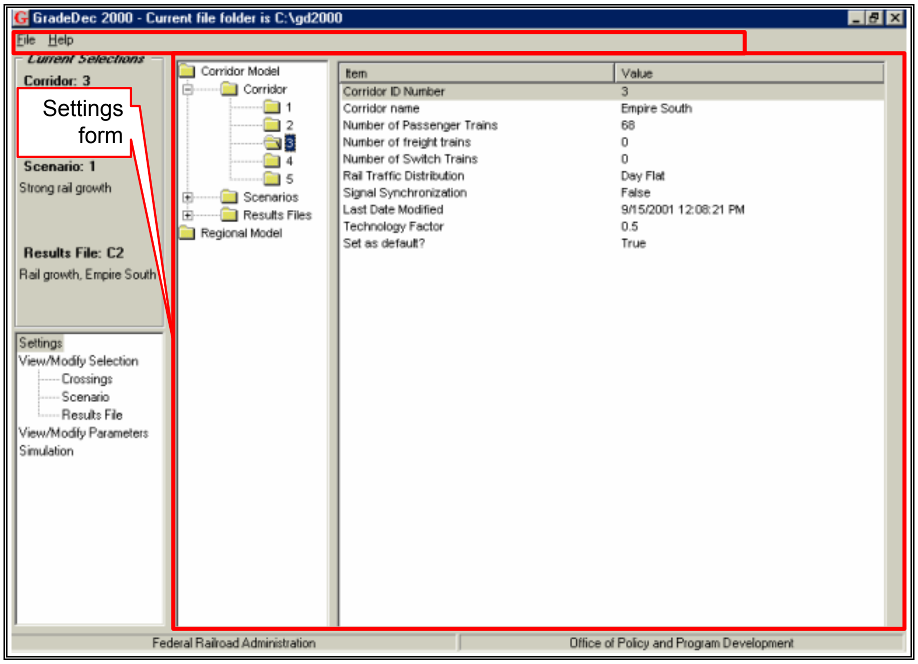

Figure 5 Settings Form (outlined)

Description

This form is the first form you see (embedded in the Main From) when you start *GradeDec 2000*. Use this form to select the *GradeDec 2000* objects that are used in the Edit/Modify and Simulation functions of the software. Use the Settings Form to create and delete *GradeDec 2000* objects and change field values for the object definitions. Use this form to set and save defaults and to set the current file folder.

The form has two main sections: the **Object Tree** on the left, and the **Item List** on the right. The **Item List** displays the details of the selected node from the **Object Tree**.

How you invoke this form

The **Settings Form** is displayed on start up. You can return to the **Settings Form** by double-clicking on the “Settings” node of the **Function Tree**.

Purpose and Function

Use this form to:

- Set the current file folder;
- Select corridor or region; scenario; and, results file;
- Create new definitions of corridors/regions, scenarios and results files;
- Delete corridors/regions, scenarios or results files;
- Modify fields in the definitions of corridors, regions, scenarios or results file;
- Save and restore defaults;

The Object Tree

Use the **Object Tree** to navigate among the *GradeDec 2000* objects, view their definitions and select objects for data entry and analysis.

There are three levels of nodes in the **Object Tree**. The top level contains nodes that represent the choice of model, either Corridor Model or Regional Model. The second level contains nodes that represent the collections of defined objects belonging to the model: Corridors (or Regions), Scenarios and Results Files. The third level of the **Object Tree** contains one node for each defined object in the collection. The figure below shows the expanded tree for Scenarios in the Corridor Model:

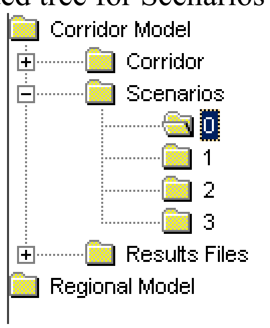

Figure 6 Example of Expanded Object Tree

The expanded top-level node is the current model (in the figure above, the Corridor Model). Its selected objects are displayed in the **Current Selections**. To alternate to the other model, click on the Regional Model node.

To view the definitions of an object in one of the collections, click on its node and its definition fields and values will appear in the **Item List** on the right side of the form.

You must double-click the object's node in order to select the object as part of your analysis (i.e., make it part of the **Current Selections**).

When you create or delete objects in *GradeDec 2000,* the **Object Tree** elements are modified accordingly.

The Item List

The **Item List** displays a list of the definition data that are associated with the object selected in the **Object Tree**. The left column of the **Item List** gives the description or field name while the column side shows the corresponding value.

The figure below shows the definition data for a Corridor Model scenario.

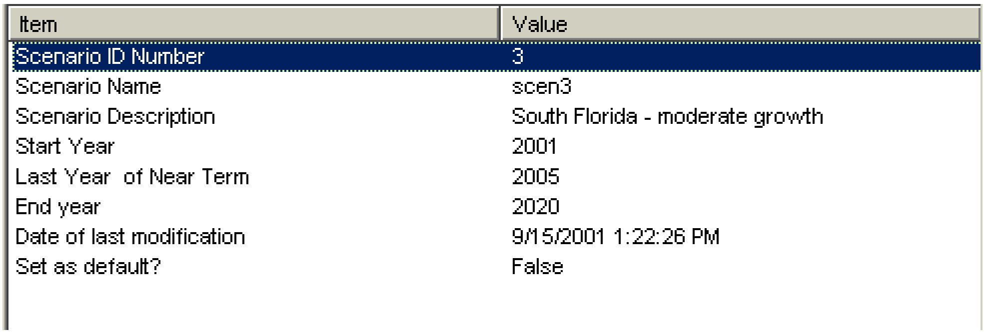

Figure 7 Example of Item List Display for a Corridor Model Scenario

Modifying Definition Data for Objects

Click on an item in the **Item List** to select it. *Back-click* to invoke the “Edit field value” box.

Figure 8 Modify Field Box - Manual Modification Permitted

For some fields, manual modification of the field value is permitted. In this case, the box will appear as above. Modify the value and click “OK” to save the value. For fields that are modified by *GradeDec 2000* processes and not by direct user input, the box will appear with a shaded region that does not permit manual modification.

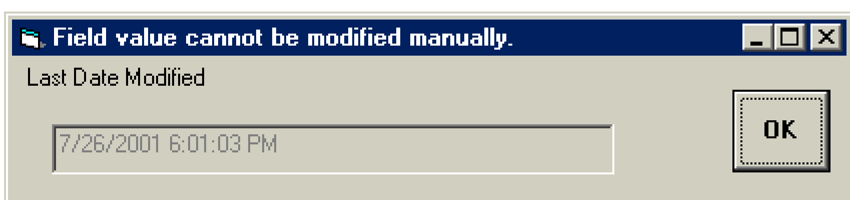

Figure 9 Modify Field Box - Manual Modification Not Permitted

The Menu

The following are the menu options and their functions:

File > Select File Folder

Using the “Select file folder” option from the menu, you can change the active database and file folder. Choose the “Select file folder” option and use the dialogue box to specify the new folder and database, and then click “OK”.

Recommended Practice: If you wish to preserve an analysis, create a new folder and copy all of the data files from your working folder (those files with sufifx .mdb) to the new folder. Then choose the "Select file folder" menu option and select the DAdata.mdb database in the new folder. All subsequent work will be recorded in the new folder (until you exit and re-enter the program, select a new folder, or restore the defaults). Save the new settings as defaults if you want to continue working in the new folder.

File>Create New>Corridor (or Region)

This option launches the New Corridor or Region Form (1.1). See its description below.

File > Defaults > Save *and* File > Defaults > Restore

The default settings are those that appear when you open *GradeDec 2000*. There are default settings for both the corridor and regional models. Settings include: The current folder, corridor or region, scenario and results file. You can restore the default settings by choosing "Defaults>Restore" from the "File" menu. You can also make your **Current Selections** the default settings by choosing the "Defaults>Save" option from the "Settings" menu.

File > Delete – selected corridor (or region) , scenario, results file

The "Delete" options in the menu will delete the corridor, region, scenario or results file that is specified in the **Current Selection**. Select (by double-clicking the object in the **Object Tree**) the corridor, region, scenario or results file you wish to delete before choosing the "Delete" option.

"Delete Corridor or Region" will delete the corridor or region (depending on whether corridor model or regional model is current) definition and all associated crossing data will be deleted from the GCX.mdb database. "Delete Scenario" will delete the scenario definition and all data associated with the scenario in the Dadata.mdb database. "Delete Results File" will delete the selected results file and its definition in the DAdata.mdb database.

Note: You cannot delete a corridor, region, scenario or results file if it is designated as the default. In order to delete a default setting, first make it non-default by saving new settings as defaults.

Help>

The three options under Help are: User's Manual, Model Reference and About. The first two options are the online help versions of the User's Manual and the Model Reference, respectively. The third option invokes an "About" form with information about the current version of *GradeDec 2000.*

Data Elements

The scenario and results file definitions are stored in the ScenDefs and Results tables, respectively, in the DAdata.mdb database. The corridor and region definitions are stored in the Corridors and Regions tables in the GCX.mdb database. The defaults are saved in a file DA.ini which is found on your computer's Windows file folder.

New Corridor or Region Form (1.1)

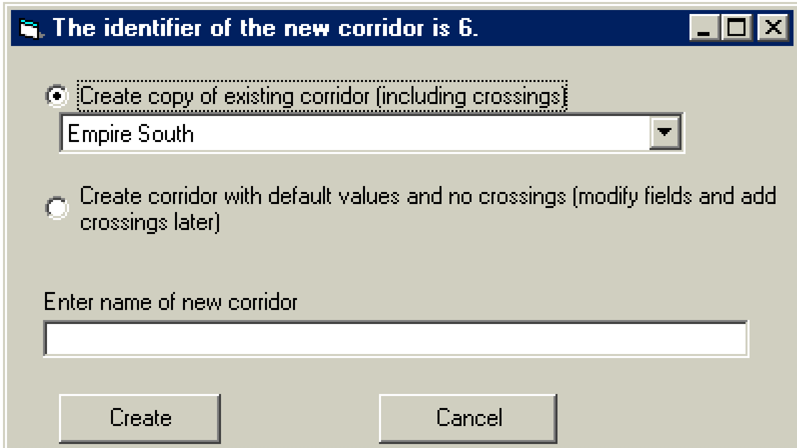

Figure 10 New Corridor Form

Description

In this form you define a new corridor or region. The new corridor (or region) can be created either as a copy of an existing corridor (or region), or as a corridor or region having default definition values and no crossings. The definition data and the crossings can be added and modified later. Use the Settings Form to modify the definition data, and use the Crossings Form to add or modify crossing data.

How you invoke this form

You invoke this form by selecting the option “Create new>Corridor (or Region)” from the File menu in the Settings Form.

Purpose and Function

Use this form to create a new corridor or region definition.

Data Elements

For this form the user needs only to specify the name of the new corridor (or region) and whether to create it as the copy of an existing corridor (or region) or as blank.

The modifiable definition data for a corridor includes: Corridor description; average number of daily trains by type (passenger, freight, switch), the time-of-day distribution of rail traffic in the corridor (selection from one of five pre-defined distributions), yes/no value indicating the presence of signal synchronization in the corridor, and a technology impact factor (a value between 0 and 1).

The modifiable definition data for a region includes: Region description; a technology impact factor (a value between 0 and 1), and a value for the percent benefits due to closure.

See the *GradeDec 2000* Model Reference for a detailed explanation of all the data elements of corridor and region definitions and their use in the models.

A corridor definition record is stored for each corridor in the Corridors table of the GCX.mdb database in the active file folder. A region definition record is stored for each region in the Regions table in the same database.

New Scenario Form (1.2)

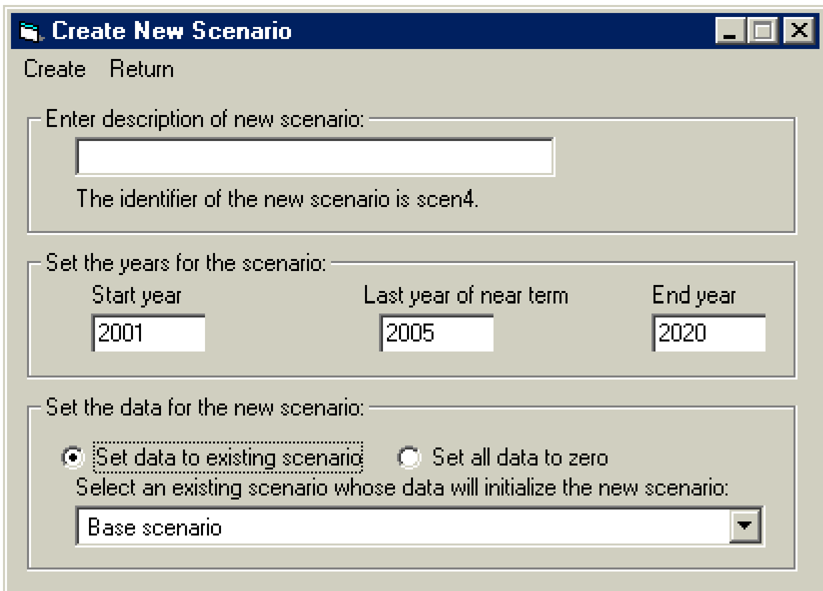

Figure 11 New Scenario Form

Description

In the New Scenario form you specify the description, the start year of the scenario, the last year of the near term and the scenario's end year. You must also specify whether to set all data values to zero, or, copy data values from an existing scenario. If you choose the "Copy Data" option, then you must specify an existing scenario using the pull-down menu in the form. Select "Create new>Create new scenario" from the menu after you complete the form.

How you invoke this form

You invoke this form by selecting the option "Create new> scenario" from the File menu in the Settings Form.

Purpose and Function

Use this form to create a new scenario. The near term and long term are for rail and highway traffic growth rates. For instance, if the start year, last year near term and last year are 2002, 2006 and 2012 and near term highway traffic growth is 4% and long term growth is 2.5%, then traffic is calculated like in the following table

	NEAR TERM					LONG TERM					
	2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
Highway traffic (AADT)	1000	1040	1082	1125	1170	1199	1229	1260	1292	1323	1357
Growth rate (%)	4	4	4	4	4	2.5	2.5	2.5	2.5	2.5	2.5

Table 1 Illustration of Near Term and Long Term in Growth Rate Calculation

Data Elements

The modifiable data for a scenario definition include: a description, a start year, the last year of the near term and the end year. The "last year of the near term" is the last year in which near-term growth rates are applied. The scenario identification number is assigned by *GradeDec 2000* and is not subject to modification by the user. The model identification number specifies whether the scenario is a scenario for the corridor model (Model ID = 1) or for the regional model (Model ID = 2).

The scenario definition data are saved in the ScenDefs table in the DAdata.mdb database.

New Results File Form (1.3)

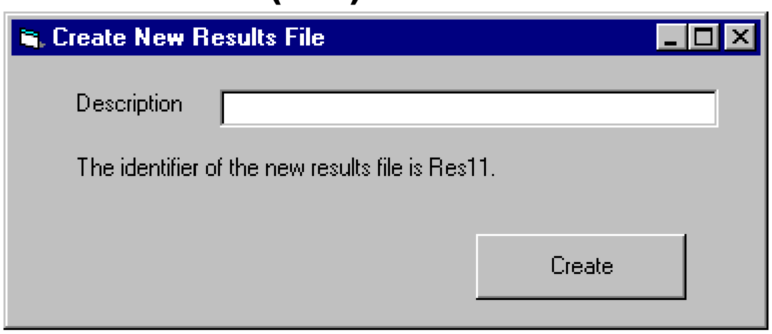

Figure 12 New Results File Form

Description

In the New Results File form you specify the description of the new results file.

How you invoke this form

You invoke this form by selecting the “Create new>Results file” option under File in the Settings Form menu.

Purpose and Function

Use this form to create a new results file definition. The new results file is created only when the simulation is run. Each time you run a simulation using the same results file as the current selection, the previous results file is deleted and a new results file is created.

Data Elements

The modifiable data for a results file definition are its description. When creating a new results file with this form, *GradeDec 2000* assigns a results file number and the corridor or regional model ID number (1 or 2, respectively). When you run a simulation, the number of trials, random seed and time-date data are written to the results file definition record. The results file definitions are stored in the Results table of the DAdata.mdb database.

The results files themselves are separate files in the active file folder and have names ResCx.mdb and ResRx.mdb where x is the identifying number that is assigned to the results definition by *GradeDec 2000* and C and R indicate whether the results belong to the corridor or the regional model, respectively.

Corridor Crossings Form (2a)

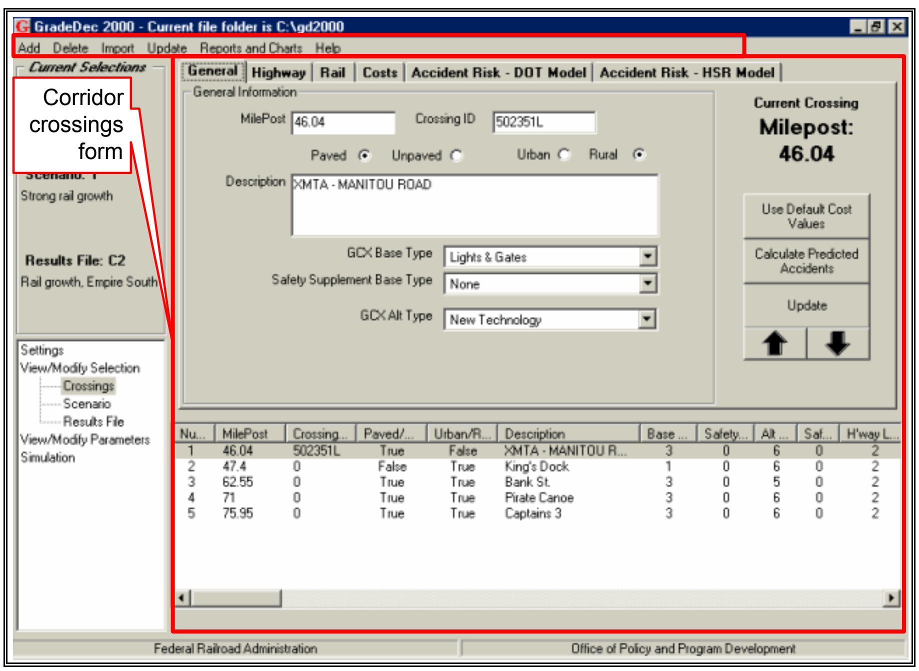

Figure 13 Corridor Crossings Form (outlined)

Description

Use this form in grade crossing corridor analysis to:

- View crossing data.
- Add, modify and delete crossing data.

- Invoke the Import Crossing Data Form for importing data from the National Inventory of Highway-Rail Grade Crossings
- Calculate predicted accidents using both the Accident Prediction and Severity Model and the High Speed Rail Model
- Print the corridor reports
- View charts ranking the crossings

How you invoke this form

You invoke this form by double-clicking on Crossings under View/Modify Selection in the **Function Tree** of the Main Form.

Purpose and Function

The **Corridor Crossing Data** form is divided into two main sections: 1) the **Crossing Data Entry Form** (top of the screen), and, 2) the **Item List** (bottom of the screen). You use the **Item List** to select a crossing for viewing or editing. Data entry and modifications to crossing data are entered on the data entry form. You navigate among topics on the data entry form for the selected crossing by clicking on a tab at the top of the form.

Several buttons on the form facilitate updates, calculations and navigation among crossings and are discussed below.

Other features can be accessed from the menu at the top of the form.

Crossing Data Entry Form

General Information

This block of the data entry form contains general information about the crossing, locational factors and its physical characteristics. The base and alternate warning device type for the crossing are the "before" and "after" improvement crossing types, respectively. Using the mouse, click on the field where you wish to enter data. For "GCX Base Type" and "GCX Alternate Type", use the pull-down menus.

Note: When analyzing a corridor, you must specify in the data the milepost location of each grade crossing.

If one of the selected crossing types is "Lights and Gates" a pull-down menu appears below the warning device type. With this pull-down menu you designate the supplementary safety measure that is implemented (in the base) or planned (in the alternate).

Highway

The highway data block includes data entry boxes for the number of lanes, AADT and percentages of trucks (and of trucks, percent truck-trailers) and buses. The data block also includes pull-down menus where the user specifies the time-of-day traffic distribution for auto, truck and bus traffic.

Rail

In the rail data block the user specifies the number of tracks and train speeds. The user specifies the maximum timetable speed at the crossing and the average speeds traveled by trains of different types at the crossing.

Costs

The cost data block contains the cost data for the crossing in the base and alternate cases. You can enter the data manually for each crossing, or you can use the default costs by pressing "Use Default Values".

If a crossing device type is set to “Lights and Gates” and a supplementary safety measure is chosen, then the user can specify the costs for the supplementary measure in the appropriate boxes.

Predicted Accidents

This block contains one data entry box for the number of accidents at the crossing in the preceding five-year period. The other information on this section of the form is the predicted number of accidents for the crossing and the corridor (calculated based upon the data for the crossing and corridor). Predicted accidents are updated when the user presses the "Calculate Predicted Accidents" button. The rates and predicted accidents are calculated using the US DOT Accident Prediction and Severity Formulas and Resource Allocation Method (see the *GradeDec 2000* Model Reference and Documentation).

Predicted Accidents – HSR Model

This portion of the data entry form shows the predicted accidents using the High Speed Rail Model. The predicted accidents on this block of the form are updated when the user presses the "Calculate Predicted Accidents" button.

Use Default Costs Button

This button will automatically fill the cost data boxes with the default values. The default cost values can be modified in the Parameters and Default Values Form.

Calculate Predicted Accidents Button

After modifying data for a crossing, press the “Calculate Predicted Accidents” to update the crossing data in the database and calculate predicted accidents for each crossing in the corridor and in the corridor as a whole.

Update Data Button

After entering or modifying the data for a grade crossing, press the “Update” button to save the new data in the crossings database. If you move to another crossing in the item list or exit the Corridor Crossing Data form without pressing the “Update” button or the “Calculate Predicted Accidents” button, you will lose any information that you entered since you last pressed “Update”.

Note: Pressing the "Update" button does not recalculate the predicted accidents and rates based upon new or changed crossing or corridor data. In order to recalculate the rates and save them in the crossing database you must press the "Calculate Predicted Accidents" button.

Navigation Arrows

Clicking on these arrows moves the selection to the next crossing in the **Item List.** When the selected item changes, the data of the selected item are shown in the data entry form.

Item List

Click on a row in the **Item List** selects a crossing. This will display the crossing's information on the Corridor Crossings Form data entry section. Using the shift button and the control button you can select multiple crossings (only the first crossing selected is shown in the Crossing Data Entry form). Delete multiple selections with the "Delete" function in the form's menu.

Corridor Crossing Data Form Menu

Add

Choosing the “Add” option in the menu will give a blank form for entering data for a new crossing. If you enter a milepost that already exists, the new data that you enter will overwrite the existing data for the crossing when you press “Update”.

Delete

Choosing the “Delete>Delete selected grade crossings(s)” option will delete the the selected crossing(s).

Import

The menu option “Import>Import data” invokes the Import Data form. From this form the user can import data from the National Inventory of Grade Crossings.

Update

The "Update>Update costs with defaults for all records" will override existing values for costs for all crossings in the corridor and replace them with the default cost values.

Reports and Charts

"Print Corridor – DOT Model Report"

Prints a report of the data for the corridor including all crossings and the associated predicted accidents using the DOT model.

"Print Corridor – HSR Model Report"

Prints a report of the data for the corridor including all crossings and the associated predicted accidents and rates using the High Speed Rail model.

"Crossing Risk Charts (DOT Model)"

Launches risk ranking charts with DOT model (see form 2.1 below).

"Crossing Risk Charts (HSR Model)"

Launches risk ranking charts with HSR model (see form 2.1 below).

Help

Launches the User's Manual on-line help system.

Data Elements

Crossing data are stored in the GCXdata table of the GCX.mdb database in the file folder. Crossing record have both raw data fields and calculated fields that contain predicted accidents by type for the base and alternate cases.

Crossings Ranking Charts Form (2.1)

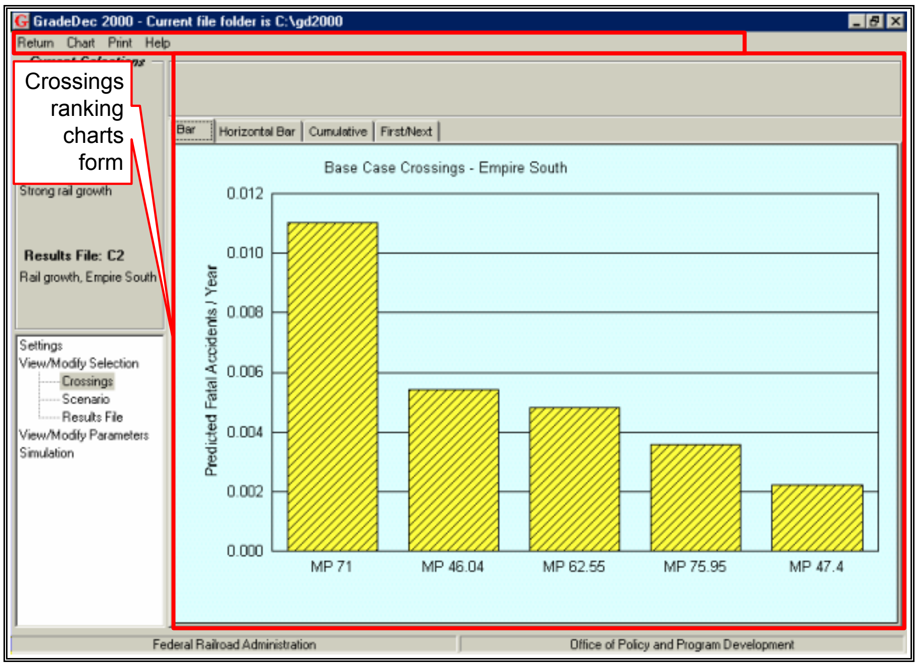

Figure 14 Crossing Ranking Charts Form (outlined)

Description

This form displays a series of charts that rank the crossings in a corridor based upon predicted fatal accidents (for the DOT model) or predicted fatalities (for the HSR model).

How you invoke this form

You invoke this:

- From the Corridor Crossings From using menu options: " Reports and Charts>Crossing Risk Charts (DOT Model)" or "Reports and Charts>Crossing Risk Charts (HSR Model)".
- From the Regional Crossings From using menu options "Reports and Charts>Crossing Risk Charts"

Purpose and Function

This form displays a ranking of crossing by risk for both the base and the alternate cases. The form includes several charts, namely:

- Risk ranking - bar chart
- Risk ranking - horizontal bar chart
- Cumulative risk by ranked crossings
- First/Next chart – stacked bars showing risk at fist n crossings and next m crossings.

The form displays a maximum number of 30 crossings. The user can manually set the maximum number of crossings to less than 30.

Data Elements

This form displays data that was entered, calculated and stored with the Crossing Data Form.

Import Crossing Data Form (2.2)

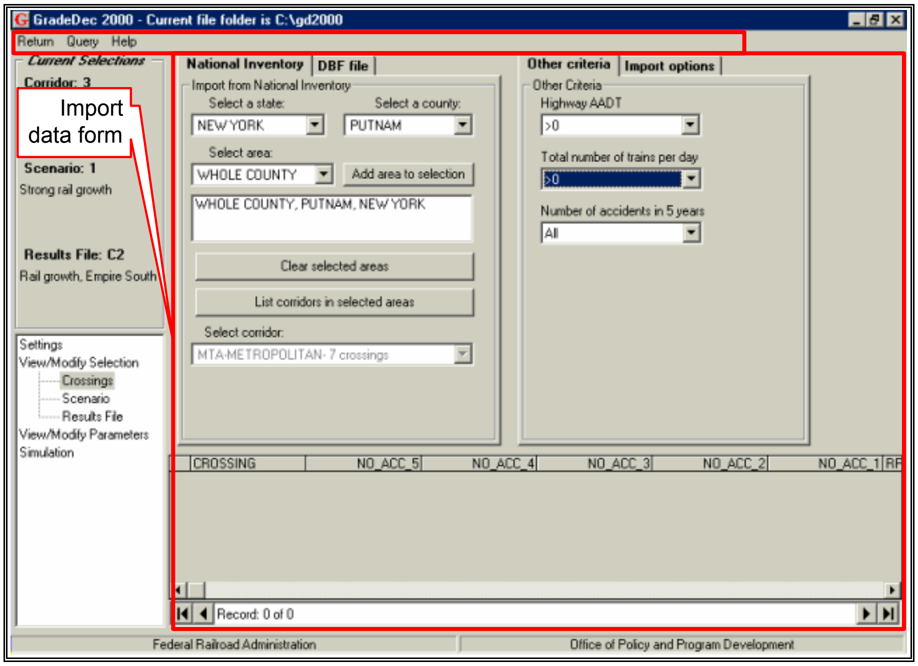

Figure 15 Import Crossing Data Form (outlined)

Description

Use this form to import data from the Federal Railroad Administration's National Inventory of Highway-Rail Grade Crossings database and GIS application programs.

How you invoke this form

You invoke this form by choosing the "Import" option in the menu on the Corridor Crossing Data Form, or on the Regional Crossing Data form.

Purpose and Function

The purpose of this form is to enable the analyst to import data from the National Inventory of Highway-Rail Grade Crossings database into *GradeDec 2000* for analysis*. The form lets the user build a query based on geography, identified corridors and grade crossing characteristics. The form also enables the specification of automatic mapping to *GradeDec 2000* fields. The following sections describe the different parts of the form and their functions.

For GIS applications capable of extracting data sets of crossings in .DBF file format, and whose field names exactly match those of the National Grade Crossing Inventory, this form can import data from such extracted files.

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* The data in FRA's National Inventory of Highway-Rail Grade Crossings are submitted by state DOTs and should be reviewed for accuracy.

Importing Data from the National Inventory of Grade Crossings

In order to import data from the National Inventory of Grade Crossings, the file PCAPS32.mdb must exist in a subfolder \PCAPS of your *GradeDec 2000* current file folder. When the Data Import form opens it shows the National Inventory tab as selected (the default position). If not selected, select this tab.

"Select a State", "Select a County", "Select Area"

In this part of the form, the user chooses first the state and then the county from the pull-down menu boxes. After selecting the county, the user should select an area, which is an area within the county (i.e., "the whole county", a specific city, or "not in any city"). After selecting the area, press, "Add area to selection".

For Corridor Model Only

After selecting the areas for inclusion, use the pull-down menu to select crossings that are identified as being in a specific corridor.

Press the "Clear selected areas" button to delete your selections and start over.

"Other Criteria"

The "Other Criteria" section allows the user to restrict the crossings to import to those that meet specific criteria. The criteria include: average annual daily traffic, number of trains per day and number of accidents in the previous 5 years.

Note: While *GradeDec 2000* allows you to import records that have no train or highway traffic, be aware that the absence of either at a grade crossing will cause a computational error in the model (e.g., divide by zero). To avoid this, you should either exclude crossings with no traffic, or enter data manually for these crossings (assuming that this reflects actual conditions at the crossings).

For Corridor Model Only

Note: After setting "Other Criteria" you need to reselect the corridor.

"Import Options"

Use this section to determine the automated filling of *GradeDec 2000* fields when importing data. You can specify to use default cost data, or leave cost data blank for manual data entry. The base grade crossing type is the type specified in the National Inventory of Highway-Rail Grade Crossings database. The alternative grade crossing type can be automatically designated using the pull-down menus, or the user can specify that alternative crossing types will be manually entered.

Menu Options

From the form's menu, with Query>View you can view the SQL query statement that is built from your selections (this is an expert option). Query>Run will query the database and fill the data grid at the bottom of the form with the grade crossings from selected areas or corridors that meet all the criteria..

By selecting "Return>Return without importing data", you return to the Crossing Data form that invoked the Import Data Form, without importing data.

By selecting "Return>Return and import data", you return to the invoking Crossing Form while importing the requested data. The instructions that you specified in the Import Data form for automatic field fill are executed and the new data records are appended to the existing records in the selected region. After importing, predicted accidents are calculated for all crossings as well as a summary for the corridor or region.

If upon importing data a record already exists with the same crossing ID as a newly imported crossing, the existing record in the region is overwritten by the imported data.

Importing Data from DBF files

Specify the location of the file in the pull-down menus and use the menu options to import.

Data Elements

The Import Data form imports data from the National Inventory of Highway-Rail Grade Crossings (the database called PCAPS32.mdb) and creates records for use in *GradeDec 2000*. .DBF files must conform to the field naming conventions used in the PCAPS32.mdb database.

Regional Crossings Form (2b)

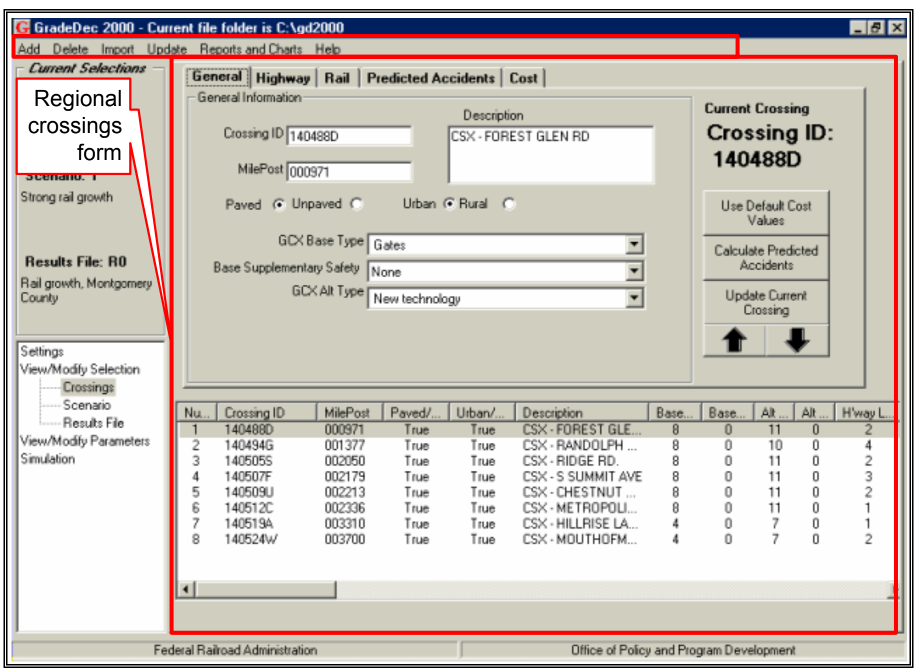


Figure 16 Regional Crossings Form

Description

Use this form in grade crossing regional analysis to:

- View crossing data.
- Add, modify and delete crossing data.
- Invoke the Import Crossing Data form for importing data from the National Inventory of Highway-Rail Grade Crossings
- Calculate predicted accidents
- Print the corridor reports
- View charts ranking the crossings

How you invoke this form

You invoke this form by double-clicking on Crossings under View/Modify Selection in the **Function Tree** of the Main Form.

Purpose and Function

The **Regional Crossing Data** form is divided into two main sections: 1) the **Crossing Data Entry Form** (top of the screen), and, 2) the **Item List** (bottom of the screen). You use the **Item List** to select a crossing for viewing or editing. Data entry and modifications to crossing data are entered on the data entry form. You navigate among topics on the data entry form for the selected crossing by clicking on a tab at the top of the form.

Several buttons on the form facilitate updates, calculations and navigation among crossings and are discussed below.

Other features can be accessed from the menu at the top of the very top of the form.

Crossing Data Entry Form

General Information

This block of the data entry form contains general information about the crossing, locational factors and its physical characteristics. The base and alternate warning device type for the crossing are the "before" and "after" improvement crossing types, respectively. Using the mouse, click on the field where you wish to enter data. For “GCX Base Type” and "GCX Alternate Type", use the pull-down menus.

If one of the selected crossing types is “Lights and Gates” a pull-down menu appears below the warning device type. With this pull-down menu you designate the supplementary safety measure that is implemented (in the base) or planned (in the alternate).

Highway

The highway data block includes data entry boxes for the number of lanes, AADT and percentages of trucks (and of trucks, percent truck-trailers) and buses. The data block also includes pull-down menus where the user specifies the time-of-day traffic distribution for auto, truck and bus traffic.

Rail

In the rail data block the user specifies the number of tracks, trains per day, rail traffic time-of-day distribution and average train speeds. The user specifies the maximum timetable speed at the crossing and the average speeds traveled by trains of different types at the crossing.

Costs

The cost data block contains the cost data for the crossing in the base and alternate cases. You can enter the data manually for each crossing, or you can use the default costs by pressing "Use Default Values".

If a crossing device type is set to “Lights and Gates” and a supplementary safety measure is chosen, then the use can specify the costs for the supplementary measure in the appropriate boxes.

Predicted Accidents

This block contains data entry boxes for accidents at the crossing in each of the years in the preceding five-year period. The other information that is presented on this form is the predicted number of accidents for the crossing and region. Predicted accidents are updated when the user presses the "Calculate Predicted Accidents" button. The predicted accidents are calculated using the US DOT Accident Prediction and Severity Formulas and Resource Allocation Method (see the *GradeDec 2000* Model Reference and Documentation).

Use Default Costs Button

This button will automatically fill the cost data boxes with the default values. The default cost values can be modified in the Parameters and Default Values Form.

Calculate Predicted Accidents Button

After modifying data for a crossing, press the “Calculate Predicted Accidents” to update the crossing data in the database and calculate predicted accidents for each crossing in the region and in the region as a whole.

Update Data Button

After entering or modifying the data for a grade crossing, press the “Update” button to save the new data in the crossings database. If you move to another crossing in the item list or exit the Regional Crossing Data form without pressing the “Update” button or the “Calculate Predicted Accidents” button, you will lose any information that you entered since you last pressed “Update”.

Note: Pressing the "Update" button does not recalculate the predicted accidents and rates based upon new or changed crossing or regional data. In order to recalculate the rates and save them in the crossing database you must press the "Calculate Predicted Accidents" button.

Navigation Arrows

Clicking on these arrows moves the selection to the next crossing in the **Item List.** When the selected item changes, the data of the selected item are shown in the data entry form.

Item List

Click on a row in the **Item List** selects a crossing. This will display the crossing's information on the Regional Crossings Form data entry section. Using the shift button and the control button you can select multiple crossings (only the first crossing selected is shown in the Crossing Data Entry form). Delete multiple selections using the "Delete" function in the form's menu.

Regional Crossing Data Form Menu

Add

Choosing the “Add” option in the menu will give a blank form for entering data for a new crossing. If you enter a milepost that already exists, the new data that you enter will overwrite the existing data for the crossing when you press “Update”. Otherwise, pressing “Update” will record the new crossing in the crossings database.

Delete

Choosing the “Delete>Delete selected grade crossings(s)” option will delete the data for the selected crossing(s).

Import

The menu option “Import>Import data” invokes the Import Data form. From this form the user can import data from the National Inventory of Highway-Rail Grade Crossings.

Update

The "Update>Update costs with defaults for all records" will override existing values for costs for all crossings in the region and replace them with the default cost values.

Reports and Charts

"Print crossing data report"

Prints a report of the data for the region including all crossings and the associated predicted accidents.

"Show Risk Charts"

Launches risk ranking charts (see form 2.1 above).

Help

Launches the User's Manual on-line help system.

Data Elements

Use this form to view, enter, modify or delete crossing data for a corridor analysis. Crossing data are stored in the RGCXdata table of the GCX.mdb database in the file folder. Each crossing record includes fields for raw data and fields for the calculated predicted accidents by type for the base and alternate cases.

Scenario Form (3)

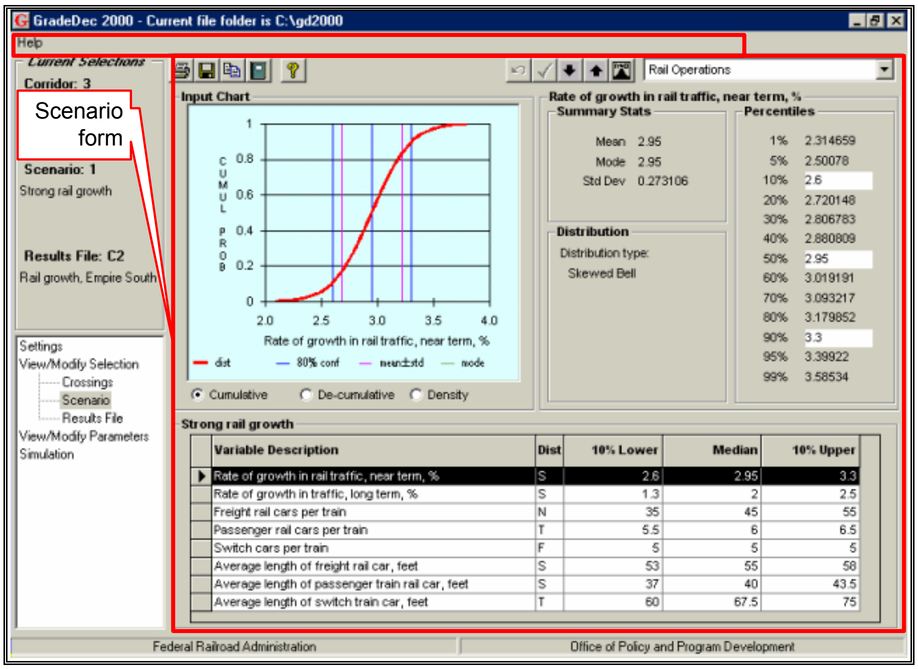


Figure 17 Scenario Data Input Form

Description

The Scenario Input Screen is where you view and edit scenario data for an analysis. Scenario data for a model input variable can be either a fixed value, or several values that describe a probability distribution.

This form possesses a number of features that let you easily visualize data and let you quickly develop probability distributions that best reflect available information and judgments on operations, future developments and social costs. These features include:

- Ease of navigation among variables;
- Instant viewing of statistics and charts
- Instant validation and saving of ranges
- Seamless connectivity with spreadsheet software.

How you invoke this form

Invoke this form by selecting "Scenarios" under "View/Modify Selection" in the **Function Tree** of the Main Form**.**

Purpose and Function

The Scenario Form is shown above. The input variables in *GradeDec 2000* are organized into data sheets according to a functional classification. The data sheets are:

- Rail Operations
- Highway
- Social Costs
- Price Growth Rates

When you invoke the Scenario Form the Rail Operations sheet is loaded and the first variable in that sheet is selected and shown in the chart and tables. You browse among the different sheets using the pull-down menu in the upper right-hand corner of the form.

The remainder of this section describes each component of the Scenario Form and their functions.

Toolbar

The toolbar at the top of the form contains several icon buttons that perform the following functions.

Print (the printer icon)

The print button prints a snapshot of the form. It invokes your system's printer dialogue box from which you can adjust your printer settings before printing.

Export (the diskette icon)

The export button sends all of the scenario data to a Microsoft Excel 5.0 spreadsheet. The scenario data will include one row for each variable and the following columns: a) variable name, b) the first value, c) the second value, d) the third value, e) the correlation factor (inactive future option), f) the distribution type, and g) description of the variable. See the discussion on exporting and importing in the section on the Import Data Form.

After pressing the icon, the file dialogue box will appear and you will be prompted to either approve the default file path and name or enter a new path and name.

Import (the copy icon)

In order to import data follow these steps: 1) Use a spreadsheet program to open the Microsoft Excel file that was generated using the export feature above, 2) make your changes to the data, 3) select the range of data to import and copy it to the clipboard

(Ctrl+C or "Edit-Copy" in most programs), 4) return to *GradeDec 2000* and choose the Import (copy icon) button on the toolbar of the Scenario Form.

The range you select and copy must include the five columns a) through e) noted in the "Export" section above. You should not include the column header, that is, never include row 1 (see the Import Data form below).

When you press the copy icon in *GradeDec 2000* a message box will appear asking whether you have copied the data for import to the clipboard. Press "Ok". A *GradeDec 2000* spreadsheet will appear and you have another opportunity to modify the data for import. When you are ready, click the "Import" button to import the data.

Print Report

The report icon will print a report of the current scenario.

Help

The "Help" button invokes the online help system.

Undo

Make changes to the current variable by entering data in the text boxes on the form and using the "Select probability distribution" button on the toolbar. Use the "Undo" button to restore the saved values for the value and undo any changes you have made.

Update

After making changes to the current variable's data or probability distribution type, save it by pressing "Update". "Update" tests that the changes to the data are valid (i.e., 10-50-90 values are increasing) and then saves the data in the database.

Next Variable (down arrow icon)

Pressing the button with the down arrow icon selects the next variable in the data set.

Previous Variable (up arrow icon)

Pressing the button with the up arrow icon selects the previous variable in the data set.

Select probability distribution (bell-shaped curve icon)

For each scenario input variable, you can specify a probability distribution. The input values and the choice of probability distribution type determine the probability distribution for the input variable.

The types of probability distributions from which you can choose are:

Fixed Value (single value required)

When you choose fixed value, there is no distribution and the variable assumes a unitary, fixed value in a simulation. For a fixed value, no statistics are shown and only the middle percentile box is enabled for data entry. No chart is shown for a fixed value.

Skewed Bell (three values required – 10, 50 and 90 percentiles)

The skewed bell distribution is derived from three points: the 10% lower value, the 50% value (or, median) and the 10% upper value. For non-skewed values the distribution is normal.

This distribution is useful when the exact form of the distribution is not known yet good estimates on the median and boundary values are available.

When this distribution type is selected, the 10, 50 and 90 percentile boxes in the percentiles table are enabled for data entry.

Normal (two values required – mean and standard deviation)

For this distribution, enter data in the statistical summary frame. The mean and standard deviation are available for data entry when this distribution type is selected.

Use this distribution type when you have data indicating the variable is non-skewed and normally distributed.

Uniform (two values required – maximum and minimum value)

With the uniform distribution every point on an interval is equally likely. When you select this distribution type, the 0 percentile and 100 percentile are enabled for data entry.

Triangle (three values required – maximum, minimum and mode)

For the triangle distribution, you enter data for the maximum value, the minimum value and the most likely value (the mode of the distribution). All values for this distribution lie between the minimum and the maximum and its density function forms a triangle with its peak at the mode. Use this distribution when the variable and data indicate firm bounds on the maximum and minimum values and a most likely value.

Data Sheet Pull-Down Menu

Use this pull-down menu in the upper-right-hand corner of the screen to select the data sheet to view and edit.

Input Chart Area

The chart area contains the chart corresponding to the selected variable. The chart will update automatically when the data are changed or a new variable is selected. For a fixed value, the chart will display the message “No Chart for Fixed Value”.

There are three chart types and each shows vertical lines that represent: the mean value, the mean value plus and minus the standard deviation, the mode of the distribution and the values for the 10, 50 and 90 percentiles. The x-axis on all the charts ranges between the values whose probabilities are 0.1 and 99.9 percent, respectively. The different chart types are selected using the option buttons located beneath the charts.

Back-clicking on the chart allows you to select which sets of vertical lines to display.

Cumulative

Chart of the cumulative probability distribution -- see glossary for definition.

De-cumulative

Chart of the de-cumulative probability distribution -- see glossary for definition.

Density

Chart of the probability density function -- see glossary for definition.

Upper Right Section of Form

The upper right section of the Scenario Form shows the summary statistics, the percentiles and the distribution type for the current variable. The caption of the frame surrounding these elements displays a description of the current variable.

Summary statistics

The summary statistics frame displays the mean, mode and standard deviation of the distribution. When the normal distribution type is selected, the mean and standard deviation are input boxes for data entry. With the triangle distribution, the mode is enabled as an input box.

See the glossary for the definitions.

Percentiles

The percentiles frame displays the percentiles of the distribution. When "skewed bell" is the selected distribution, the 10-50-90 percentiles show input boxes for data entry. When the uniform or triangle distribution is selected, the 0 and 100 percentiles show input boxes for data entry.

Variable data grid

The variable data grid enables a quick overview of the data in the selected data sheet. You can rapidly navigate to a specific variable by scrolling to and clicking on it in the data grid (as an alternative to moving with the arrow buttons in the toolbar). The data grid highlights the selected variable.

The variable data grid is located on the bottom part of the form. For each variable in the data sheet it displays the variable description, a letter symolizing the distribution type, and three values. Depending on the distribution type of the current (highlighted) variable, the column headers of the grid display the meaning that corresponds to each of the values.

Probability Distribution Type and its Letter Symbol	Meaning of Value 1	Meaning of Value 2	Meaning of Value 3
Fixed Value – F	Fixed value	Fixed value	Fixed value
Uniform – U	Minimum value	Median	Maximum value
Skewed Bell – S	10^{th} percentile	50^{th} percentile	90^{th} percentile
Normal – N	Mean-standard deviation	Mean	Mean+standard deviation
Triangle – T	Minimum value	Mode	Maximum value

Table 2 Data Grid Headers for Probability Distributions

Navigating the Scenario Data

You navigate among the scenario data with the use of the controls that were described above:

- The data sheet pull-down menu lets you select the subset of data from within the scenario where you want to focus your attention.
- You can use the up and down arrow buttons in the tool bar to move to any variable within the data set. Note that when you select a variable its data values appear in the data boxes in “Percentiles” “Summary Statistics”, its description will show in the caption of the upper right container frame and, the data variable grid pointer will always point to the selected variable.
- You can scroll to the variable you want to view with the variable data grid and point and click on the variable to select it.

Entering Scenario Data

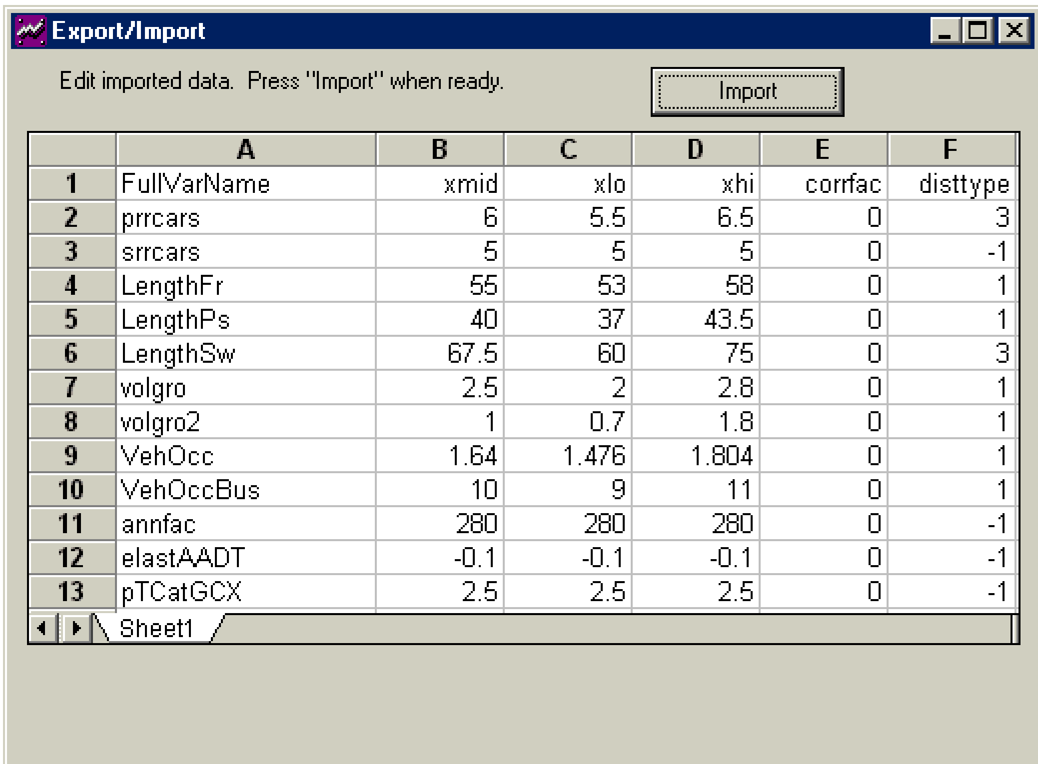
The section describes entering data one variable at a time directly on the Scenario Input Screen. Alternately, you can enter data from a spreadsheet and import it. (see the following section).

First, decide whether you wish to change the distribution type or make the input a fixed value. Chosen the distribution type using the bell-shaped curve icon in the toolbar. Then, modify the input data in the data boxes. If you wish to restore the previous values, press “Undo”. After you are satisfied with the new data values press “Update”. When you press “Update” the new values are saved. If you do not press “Update” and move to a new variable, or, exit *GradeDec 2000,* you will lose the changes you have made to the data.

Data Elements

Enter and modify scenario data through this form. Each record of scenario data includes the full variable name, the model ID number, a scenario number, a value identifying the distribution type and three data values. Scenario data are stored in the Data table of the DAdata.mdb database.

Import Scenario Data Form (3.1)


Export/Import

Edit imported data. Press "Import" when ready.

Import

	A	B	C	D	E	F
1	FullVarName	xmid	xlo	xhi	corrfac	disttype
2	prrcars	6	5.5	6.5	0	3
3	srrcars	5	5	5	0	-1
4	LengthFr	55	53	58	0	1
5	LengthPs	40	37	43.5	0	1
6	LengthSw	67.5	60	75	0	3
7	volgro	2.5	2	2.8	0	1
8	volgro2	1	0.7	1.8	0	1
9	VehOcc	1.64	1.476	1.804	0	1
10	VehOccBus	10	9	11	0	1
11	annfac	280	280	280	0	-1
12	elastAADT	-0.1	-0.1	-0.1	0	-1
13	pTCatGCX	2.5	2.5	2.5	0	-1

Sheet1

Figure 18 Scenario Data Import Form

Description

The data import form is an intermediate step in the importing of data from a spreadsheet program.

How you invoke this form

Invoke this form by pressing the import (copy icon) button on the toolbar of the Scenario Form. Invoke this form after you have copied data from a spreadsheet to the Windows clipboard.

Purpose and Function

Exporting and importing data via a spreadsheet is useful when you are initializing a scenario and wish to modify much of a scenario's data. After importing data you can then review the data one variable at time as a check.

Begin by exporting a scenario's data. To export data, just press the "Export" button in the tool bar of the Scenario Form. Specify a file name and path in the dialogue box that appears. The exported scenario will be saved in a Microsoft Excel 5.0 type file. After exporting the scenario data, you can go to your spreadsheet program and open the file.

After you have modified the data in the spreadsheet, select the data you wish to import and copy it (Ctrl+C or "Edit-copy" in most spreadsheet programs). Return to the *GradeDec 2000* program, return to the Scenario Form and press "Import" from the tool bar. See the Import and Export descriptions in the tool bar section above.

Data Elements

The Import Scenario Data Form has identical data elements to those of the Scenario Form.

Results Form (4)

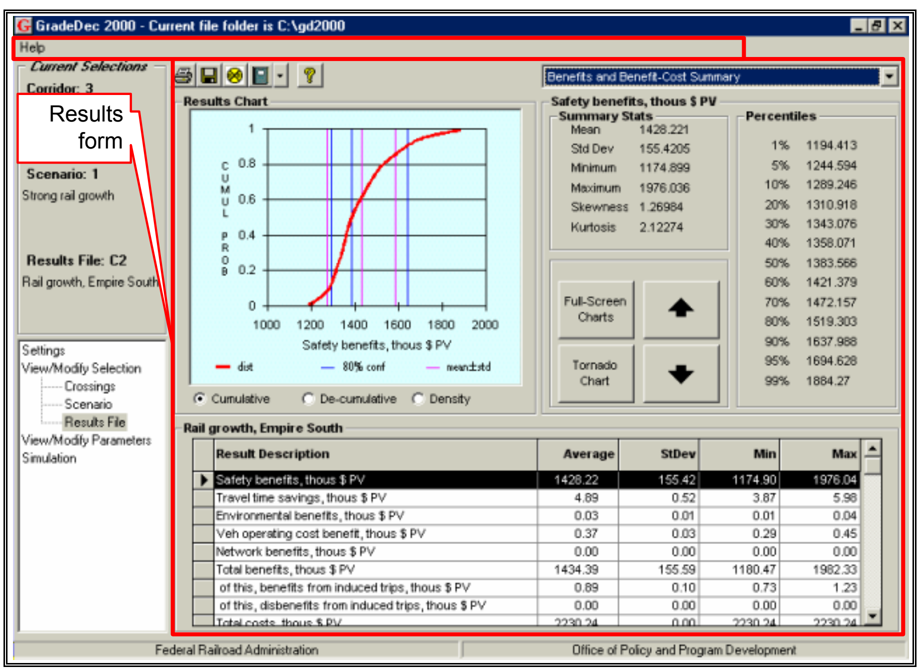


Figure 19 Results Form

Description

The results of a simulation are viewed in the Results Form.   When the form is first invoked it shows the first results data sheet and the first variable in that sheet.

How you invoke this form

When a simulation completes, this form automatically appears.

You can invoke this form manually by selecting Results File under View/Modify Selection in the **Function Tree**.

Purpose and Function

The purpose of this form is to navigate, view and print results and their associated tables and graphics. Results can be exported from this form to Microsoft Excel files.

Navigating the Results

You navigate among the results by selecting the result variable sheet with the pull-down menu in the upper right-hand corner of the screen. After selecting the result variable sheet, use the up and down arrows to find the variable of interest. Alternatively, you can scroll or point-and-click to the variable of interest in the results data grid at the bottom of the screen.

When a result is selected its statistics are shown in the tables on the form as well as a chart of the table values. Using the option buttons you can choose to display the summary chart as a cumulative, de-cumulative or probability density chart. The summary charts do not use all of the simulation data, rather, only the summary statistics in the tables are plotted in the charts. The full-screen charts plot all of the simulation result data from all trials of the simulation. To view these, press the "Full-Screen Charts" button after selecting the result variable of interest. (See Full Screen Charts Form 9.1 and Tornado Charts Form 9.2

Export and Print

Export to an Microsoft Excel spreadsheet and print the screen using the icons in the toolbar.

View Charts Ranking Grade Crossings

Clicking on the railroad crossing sign icon launches the Ranking Charts Form (4.3). See section below.

Print Results Variable Report

The report icon has a pull-down menu with print report options. The results variable report is a one-page report with tables and charts of the selected result variable (see sample reports in Appendix 1).

Print Results File Report

The results file report includes results tables of percentiles and summary statistics for every result variable in the current results file (see sample reports in Appendix 1).

Data Elements

With this form you view stored simulation results from the selected resCx.mdb (Corridor Model) or resRx.mdb (Regional Model) file.

Full-Screen Charts Form (4.1)

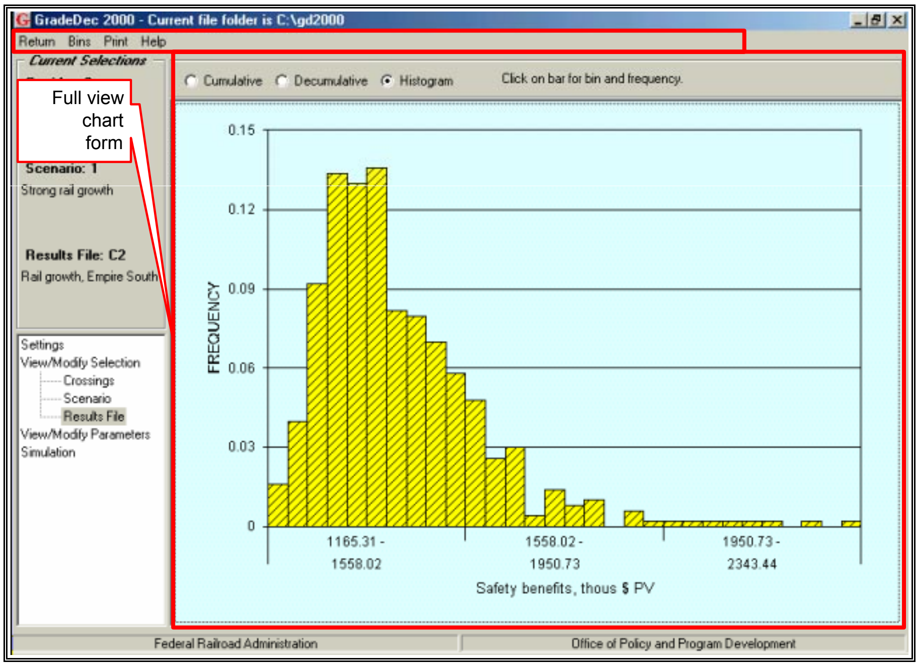


Figure 20 Full-Screen Charts Form

Description

The full-screen charts display all of a result's values from each trial of a simulation.

How you invoke this form

You invoke this form from the button "Full-Screen Charts" on the Results form.

Purpose and Function

This form is designed for in-detail viewing of a result variable.

When the form is invoked a histogram chart of the selected result variable is displayed with its values distributed into 30 probability bins. You can modify the granularity of the histogram by changing the number of bins using the "Bins" option in the form menu. By pointing and clicking on a particular bin you can view the probability of the result falling within the bin's range.

Choose the "De-cumulative" option button to view the de-cumulative probability chart. This chart shows the full range of values for the selected result and the probability of exceeding each value in its range. Pointing and clicking on a point of the curve will display the coordinates of that point. You can move to adjacent points after displaying a point by pressing the "n" key (for next) or "p" key (for previous).

The cumulative probability chart is displayed when you press the "Cumulative" option button on the form.

Data Elements

The Full-Screen charts form displays the simulation results that are stored in the SimRes table of resx.mdb database.

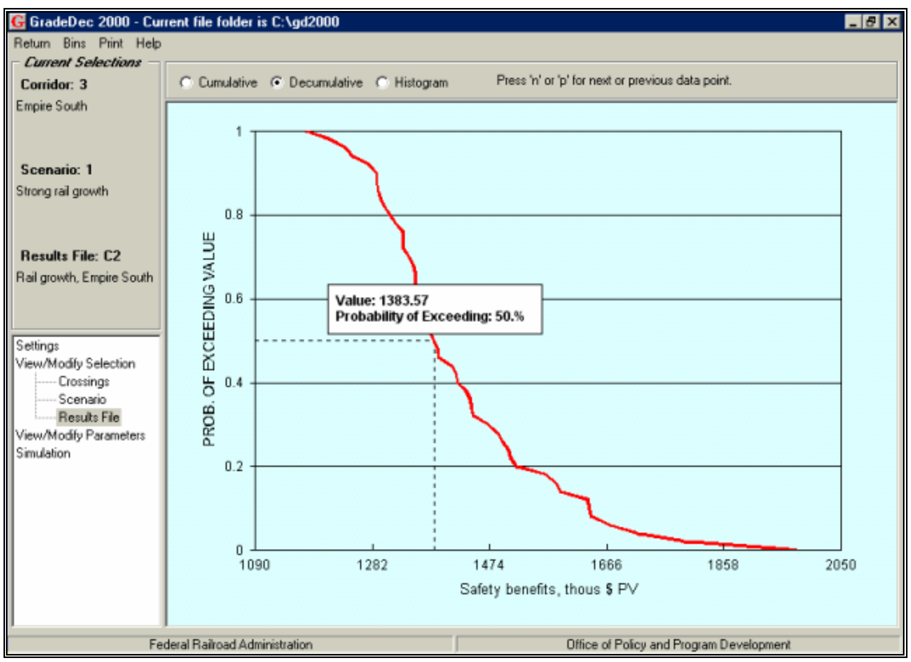


Table 3 Full Screen Chart with De-Cumulative Probability Distribution

Tornado Chart Form (4.2)

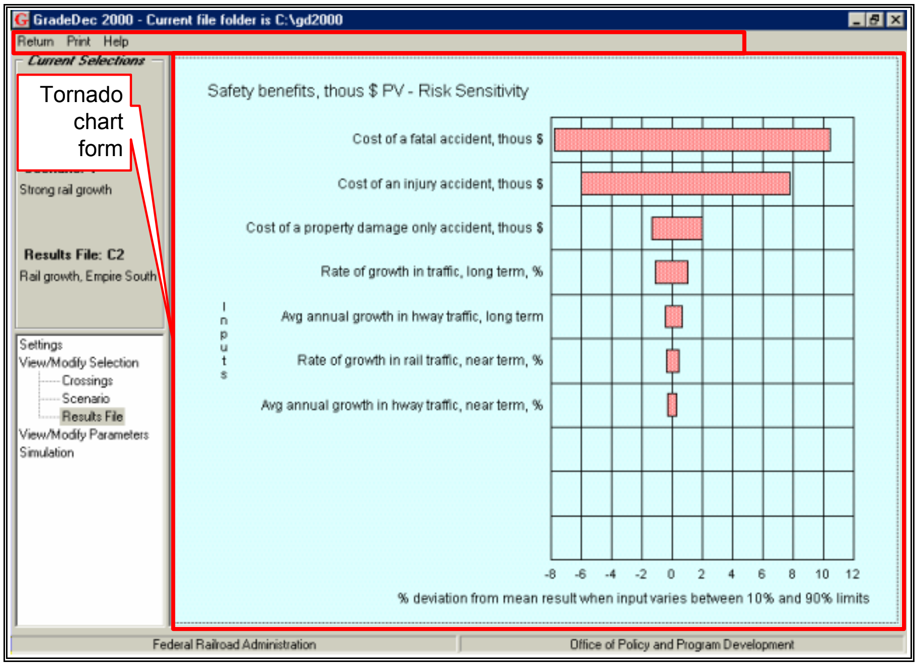


Figure 21 Tornado Chart Form

Description

The tornado chart displays the sensitivity of the risk of a result to the input variables.

How you invoke this form

You invoke this form by pressing the button "Tornado Chart" on the Results form.

Purpose and Function

An input variable contributes to risk by means of: a) its own variance, and, b) its structural role in the *GradeDec 2000* model. For instance, an input variable with large variance may not be a significant contributor to the risk of a result while an input variable with small variance may cause the result to be very uncertain and risky. Without the analysis of risk sensitivity it is not easy to determine which factors are the significant contributors to the riskiness of a particular result.

The tornado chart shows the impact of each random variable input factor when all the other input factors are set to their mean values and the single input factor is allowed to vary within its 80% confidence interval. The tornado chart displays in order the ten input variables that are the major contributors to the risk of a result.

This analysis of sensitivity can guide the analyst to focus on refining the estimates on the range of input variables that truly matter, and, help decisions makers plan for mitigating risks.

Data Elements

The tornado chart displays values from the risk sensitivity analysis that were stored in the Sens table in the resCx.mdb (or, resRx.mdb) database.

Ranking Charts Form (4.3)

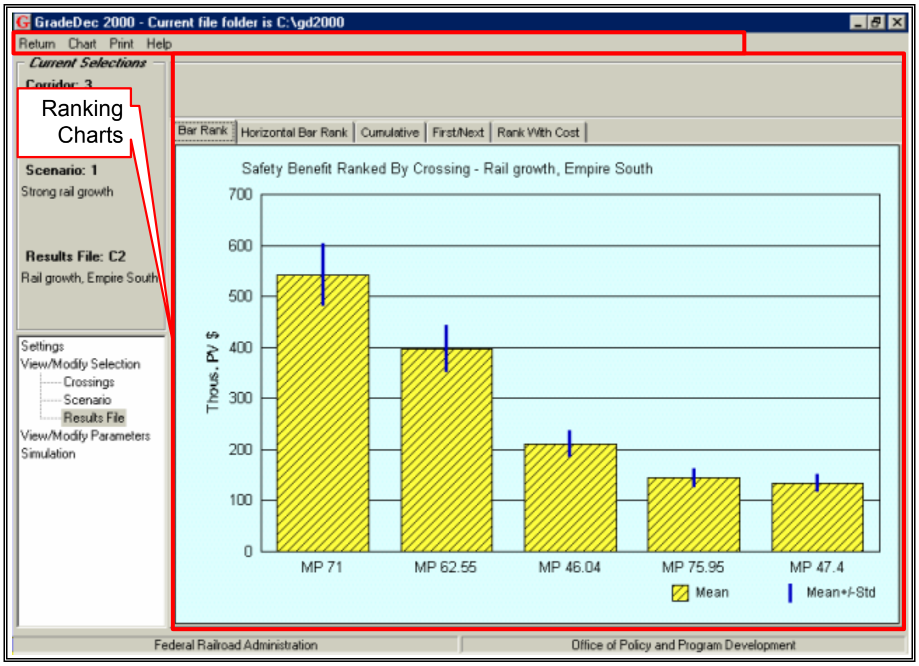


Figure 22 Ranked Bars of Benefits by Crossing with Mean and Mean Plus/Minus Standard Deviation

Description

This form contains a series of charts that illustrate the rankings of the crossings by benefits. The user can choose to rank crossings either by safety benefits only or total benefits.

How you invoke this form

You invoke this form by clicking on the railroad crossing warning icon on the toolbar in the results form.

Purpose and Function

The set of charts in this form is designed to support resource allocation decisions. The charts illustrate the relative magnitude of benefits, the riskiness of the benefits, how the ranked crossings compare with one another and the cumulative benefits from crossing improvements.

One chart also compares the ranked benefits by crossing with the costs by crossing. This view of the benefits and costs assists users to quickly identify high yield improvements and to develop improvement programs accordingly.

Data Elements

The charts display benefit and cost results that are stored in the selected results file.

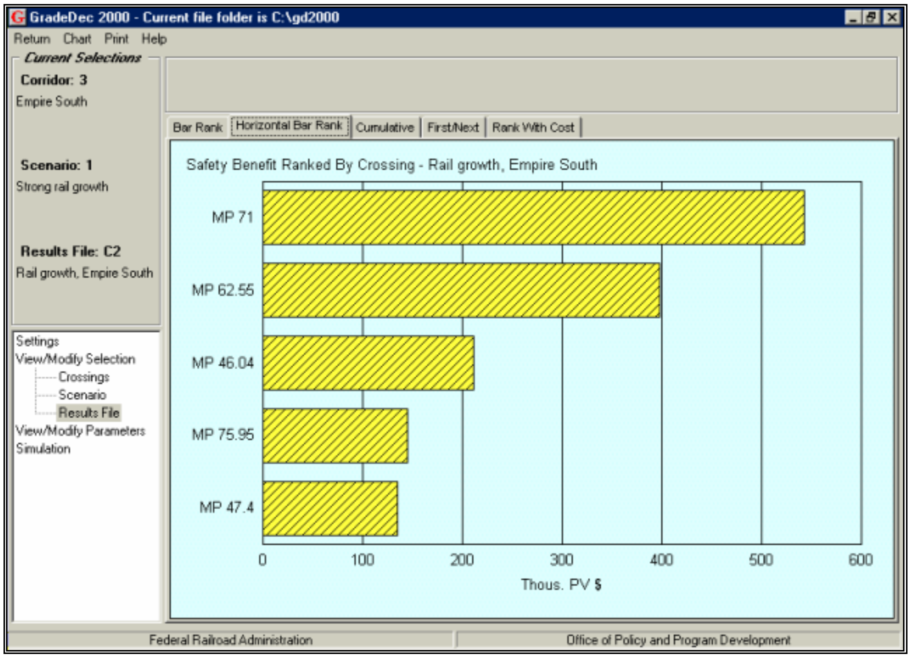


Figure 23 Ranked Horizontal Bars of Benefits by Crossing

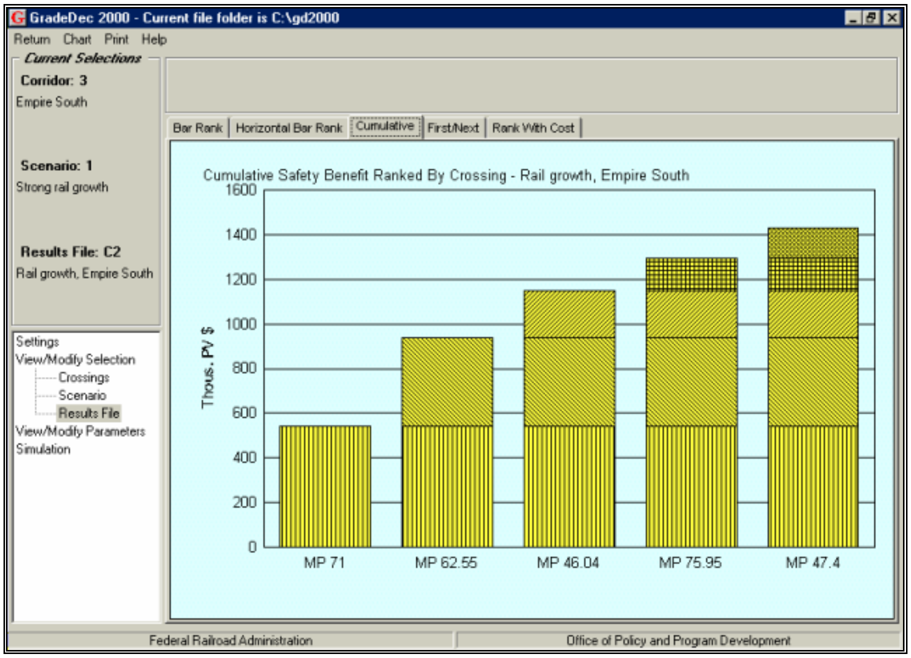


Figure 24 Ranked Bars with Cumulative Benefit

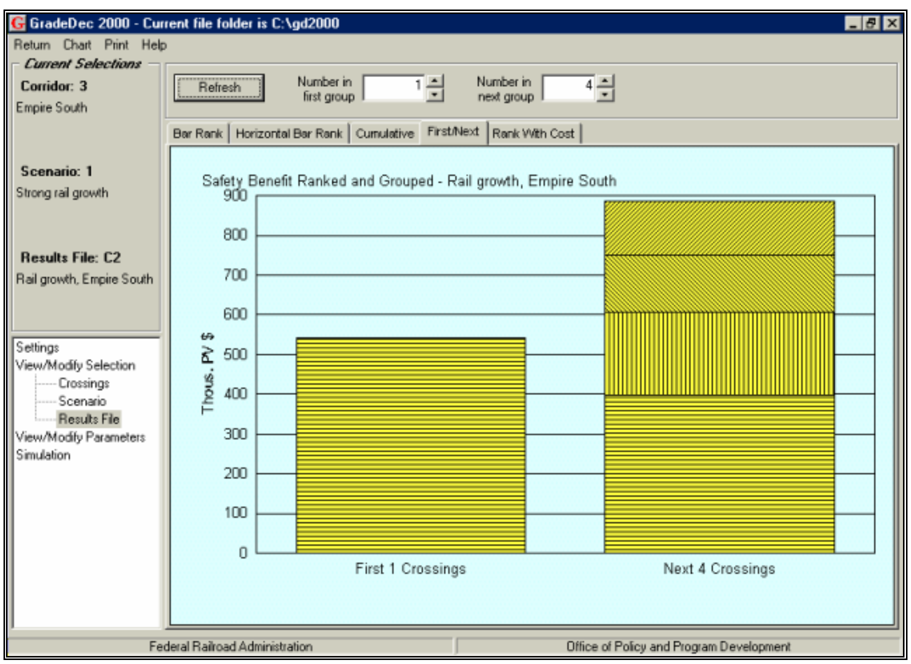


Figure 25 Crossings Ranked by Benefit Stacked by First n Crossings and Next m Crossings

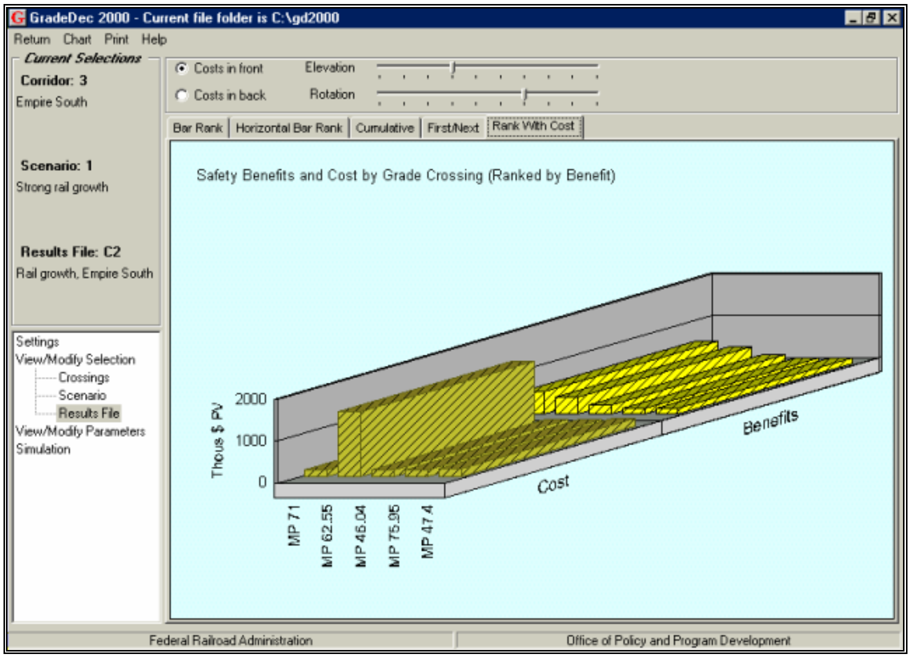


Figure 26 Crossings Ranked by Benefit shown with Costs

Parameters and Default Values Form (5)

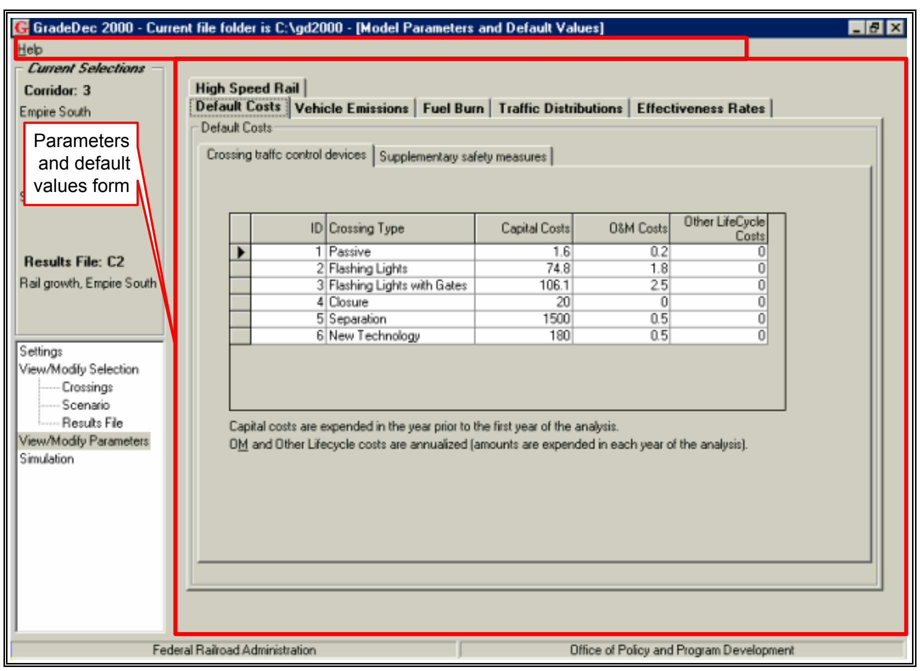


Figure 27 Parameters and Default Values Form (outlined in red)

Description

The Parameters and Default Values Form is where the user can view and modify model parameters and default values used in *GradeDec 2000*. Parameters and default values include: grade crossing default cost data, supplementary safety default cost data, supplementary safety effectiveness values, vehicle emission coefficients by vehicle type and emission type, fuel and oil burn coefficients, daily traffic time-of-day distributions, effectiveness rates and high-speed rail model coefficients. See the *GradeDec 2000* Model Reference for additional explanations.

You can modify all the parameters and values that appear on the form.

How you invoke this form

This form is invoked from the **Function Tree** by choosing View/Modify Parameters and Default Values

Purpose and Function

The form enables the user to access model parameters for reference and for editing, if necessary. In most applications it is unlikely that a user will wish to modify the emission and fuel burn coefficients. The user may wish to modify the time-of-day traffic distributions if localized information is available that better characterizes these distributions. There may well be local guidance on grade crossing operating and maintenance costs and these should be modified as needed.

Data Elements

The data elements for this form are discussed in the *GradeDec 2000* Model Reference. The analyst should verify that the default values in these tables are suitable for local conditions and modify as needed.

Simulation Form (6)

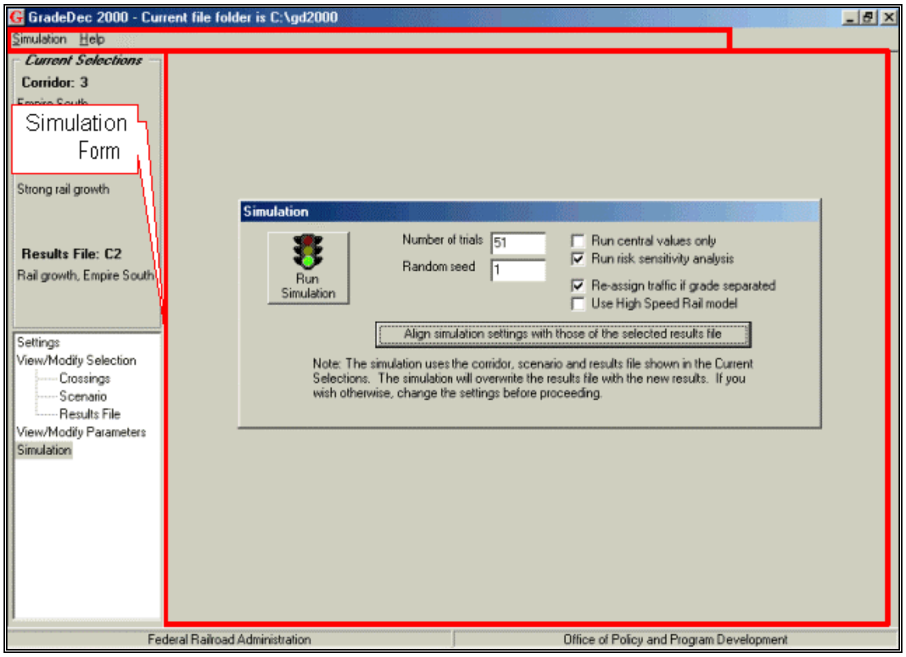


Figure 28 Simulation Form

Description

Use the Simulation form to set the simulation parameters and begin a simulation. You should invoke this form only when you are ready to conduct a simulation, that is, after having made all required modifications to data, and after having selected the corridor (or region), scenario and results file. Note that the bottom two checkboxes appear only with the corridor model and not with the regional model.

How you invoke this form

The Simulation form is invoked from the **Function Tree** by double-clicking on Simulation.

Purpose and Function

The Simulation form is used to run a simulation. Use the form to set the simulation parameters and initiate the simulation. The simulation parameters are discussed below.

About Simulation

GradeDec 2000 uses simulation, or risk analysis, to generate result forecasts. By specifying probability distributions for scenario inputs, the user quantifies their variability and uncertainty. The impact of this uncertainty on the outcomes, as reflected in the *GradeDec 2000* analytic model, is quantified using simulation.

With simulation, rather than solving the model once using "best guess" values for inputs, *GradeDec 2000* solves the model for many independent trials. In each trial, a random sample is taken from the distribution of each scenario input. Each trial produces an outcome (e.g., a set of values for the result variables) that is as likely to be achieved as any other. By applying statistical analysis to a set of outcomes, *GradeDec 2000* derives descriptive statistics for each result variable. Thus, for instance, *GradeDec 2000* will tell us not only that "the answer is 50", but also that "with 90% probability the answer lies between 30 and 75". As opposed to point estimates or sensitivity analysis (where one variable is arbitrarily varied), risk analysis supports better decisions by explicitly reporting the probability distributions of the results.

Also see the section "Why *GradeDec 2000*" in the Introduction.

“Align simulation settings with those of the selected results file”

Press this button to change the Current Settings to those specified in the selected results file.

“Run central values only” check box

Check this box to run your model using only the central values. The reported results will be point values without probability ranges. When this box is checked, the trials box and random seed box are disabled.

Trials Box

Enter the number of trials for the simulation. The number of trials is the number of times that the program will sample from the scenario input distributions, solve the model and generate results. More trials will yield more stable results and will take more time to run. While a number of factors will determine the minimum number of trials needed to achieve stable results, 500 trials will almost always be adequate. You must use at least 3 trials to run a simulation.

Recommended Practice: To save time, when testing your data and assumptions, use a small number of trials (50 or less). After you are satisfied that you will make no more changes to the data, then run a simulation with a large number of trials to arrive at your final result.

Expert Option: The user can select Latin Hypercube, the default, as the simulation method, or, alternately, the user can select the regular Monte Carlo method for simulation. Latin Hypercube is a stratified sampling method and will usually converge to the true result distribution with fewer trials than the Monte Carlo method. If you wish to know more on this subject, a good technical reference is "Latin Hypercube sampling (A Program Users Guide)", by R.L. Iman J.M. Davenport and D.K. Zeigler, Technical Report SAND79-1473, Sandia Laboratories, Albuquerque (1980)

The “Help” option provides access to the *GradeDec 2000* help file system.

Random Seed Box

The random seed determines the sequence of pseudo-random numbers that are generated by the simulation engine. Any positive integer value will generate a unique sequence of pseudo-random numbers for the simulation. Two simulations with identical data, number of trials and random seed will generate identical results.

Changing the random seed is an expert option. You may want to change the random seed to test the effects of the randomness of the sampling on the result distributions.

Risk Sensitivity Analysis Check Box

The risk sensitivity analysis, which is executed after the simulation, runs the *GradeDec 2000* model with all the input variables except one set to their mean values. The exception input variable is set to its 10 percent lower value and the model is solved. This input variable is then set to its 10 percent upper value and the model is solved again. This process is repeated for all input variables. The results of the sensitivity analysis are displayed in the tornado chart, which is invoked from the Results form.

By leaving this box unchecked your results file will not contain values for the tornado chart. When there are numerous grade crossings in a region or corridor, the risk sensitivity analysis can greatly increase the time required to run a simulation. You may prefer to sacrifice the risk sensitivity analysis in favor of shorter run times by not checking the box.

"Re-Assign Traffic, If Grade Separated" Check Box

This check box appears on the Simulation form only when using the corridor model. In the *GradeDec 2000* corridor model, there is an algorithm that re-assigns highway traffic from the adjacent grade crossings to an improved crossing with grade separation. This box is checked by default and by removing the check you choose to run your simulation without the re-assignment of traffic.

"Use HSR Model"

This check box appears on the Simulation form only when using the corridor model. If this box is checked, then the simulation uses the HSR model algorithms to calculate the safety improvements (i.e., risk reduction) at the crossings. By default, when this box is unchecked, the model uses the algorithms specified by the US DOT Accident Prediction and Severity Model. The *GradeDec 2000* Model Reference and Documentation presents a fuller description of the models and their modes of usage.

Data Elements

The number of trials and random seed values are stored in the results file definition and appear in the List View of the Main form.

Glossary of Terms

Bins

The range for a simulation result variable, that is, the values bounded by its minimum and maximum values, is divided into equal portions called bins. The result value from each trial “falls” into one of these bins. Charting the result value’s range on the horizontal axis and the probability of a result value falling in the bins yields the histogram chart.

Cumulative Probability Distribution

A cumulative probability distribution is constructed by cumulating the frequency of the probability density function. A cumulative probability distribution is an “upwardly sloping” curve, where each point on the curve gives the probability that the variable will be equal to or less than the value on the x-axis. The y-axis of the cumulative probability distribution ranges between 0 and 1. The cumulative probability distribution equals zero for a variable’s minimum value and rises to 1 at a variable’s maximum value.

De-cumulative Probability Distribution

A de-cumulative probability distribution is constructed by subtracting (or de-cumulating) a variable’s probability frequency starting with a probability of 1. A de-cumulative probability distribution is a “downward sloping” curve, where the curve gives the probability of the variable exceeding the value along the X-axis. The de-cumulative probability is 1 for a variable’s minimum value and is 0 for its maximum value (i.e., the y-axis ranges between 1 and 0).

Deterministic

The term deterministic indicates that there is no uncertainty associated with a given value, variable or model. Models that include random variables are called stochastic.

Histogram

A histogram shows the frequency of a discrete random variable and is used to display the frequency distribution of Monte Carlo simulation result variables. In a histogram, the result values are gathered in bins and the height of the bars correspond to the frequency with which values fall in the respective bins.

Kurtosis

Kurtosis is a statistical measure of a distribution's peakedness. Flatter distributions (with thin tails) are called platykurtic and peaked distributions (with fat tails) are called leptokurtic. The formula for kurtosis is:

$$\left(\frac{n(n+1)}{(n-1)(n-2)(n-3)}\frac{\sum_i (x_i - \bar{x})^4}{s^4}\right) - \frac{3(n-1)^2}{(n-2)(n-3)}$$

where $\bar{x}$ is the mean of the observations, s is the standard deviation and n is the number of observations.

Latin Hypercube

Latin Hypercube is an alternative statistical sampling method to the Monte Carlo method. This is a stratified sampling method, which means that the range for each input variable is divided into strata and one random sample is taken from each stratum. This method ensures faster convergence to the result distribution than with the Monte Carlo sampling method.

Lower 10% Value

The lower 10% value is the 10th percentile value and is the lower limit of an 80% confidence interval as input by the user.

Mean Value

The mean value for a collection of observations of a random variable is its expected value and equals the sum of the observations divided by the number of observations. For skewed distributions, the mean value is off the median value and is located in the direction of the distribution's skew.

Median Value

The median value is the 50th percentile: there is equal probability that the value for a random variable will lie above or below the median.

Mode

The mode of a probability distribution is the value for which the probability density function is at a maximum. The value has the highest probability (and is sometimes called "the most likely value", not to be confused with the mean or expected value).

Monte Carlo

Monte Carlo is the method of sampling from random variables by taking a random number on the 0-1 interval , call it *a,* and finding the value of the random variable whose cumulative probability equals *a.* Repeated Monte Carlo sampling on a number of random variables that are inputs to a model and repeatedly solving the model to arrive at probability distributions for the result variables is called Monte Carlo simulation.

Probability

Probability is the likelihood of the occurrence of a value or event.

Probability Distribution

A probability distribution or probability density function shows a continuous random variable's frequency of occurrence over its range.

Probability Density Function

Same as probability distribution.

Risk

The term refers to uncertainty in a forecast outcome. Colloquially, risk is often associated with undesirable or downside outcomes (as in "hedging against risk"). In a risk analysis, risk is reflected in the probability distributions of result variables.

Risk Analysis

Risk analysis is a term applied to several methods for quantifying uncertainty in forecasts. The risk analysis method used in GradeDec 2000 is called Monte Carlo simulation.

Random seed

The random seed is a number that initializes the generation of random numbers used in a Monte Carlo simulation. For the same random seed and the same number of trials -- given no change in the model or inputs -- the results of two Monte Carlo simulations will be identical.

Simulation

Simulation is a numeric method for finding solutions to analytically complex problems by "simulating" repeated, real world occurrences.

Skewness

Skewness is a measure of the asymmetry of a distribution. The probability density function of a skewed distribution has a longer tail on its skewed side. A right skewed distribution has skewness greater than 0 and a left skewed distribution has skewness less than 0. The formula for skewness is:

$$\frac{n}{(n-1)(n-2)} \frac{\sum_i (x_i - \bar{x})^3}{s^3}$$

where $\bar{x}$ is the mean of the observations, s is the standard deviation and n is the number of observations.

Standard Deviation

The standard deviation, which is the square root of the variance, is the principal descriptive statistic after the mean value. Knowing only a distribution's mean value and standard deviation, an upper bound can be found on the probability of any value in a variable's range. The standard deviation reported for the results is the sample standard deviation, given by the formula:

$$\sqrt{\frac{n\sum x^2 - \left(\sum x\right)^2}{n(n-1)}}$$

where n is the number of trials.

Trial

A trial is one solution of a model in a simulation. A simulation consists of many trials. In each trial, every input variable is populated with a data value sampled from the variable's probability distribution.

Upper 10% Value

The upper 10% value is the 90th percentile of a probability distribution and the upper limit of an 80% confidence interval.

Variable

A variable is a model element that can assume more than one value. A fixed-value input variable can assume only one value. A random variable can assume a range of values according to its probability distribution.

Variable data grid

The bottom portion of the Scenario Data Input form. Use this section of the form either to navigate or view the stored values for the input variable.

Variance

The variance is a measure of the dispersion of values in a probability distribution, and is a measure of risk. The variance is the average of the squared deviations about the mean. The variance gives disproportionate weight to "outliers," values that are far away from the mean. The variance is the square of the standard deviation.

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Appendix

GradeDec 2000 Reports

Corridor Report – DOT Model

Corridor Report – HSR Model

Region Report

Scenario Report

Result Variable Report

Result File Report

FEDERAL RAILROAD ADMINISTRATION

GRADEDEC 2000 - CORRIDOR MODEL

CORRIDOR DATA

Corridor ID	3	Average Number of Passenger Trains / Day	68.0
Corridor Name	Empire South	Average Number of Freight Trains / Day	0.0
Rail Traffic Time-of-Day Dist	-	Average Number of Switch Trains / Day	0.0
Technology Factor	0.50	Signal Synchronization?	No

CORRIDOR SUMMARY OF PREDICTED ANNUAL ACCIDENTS

	Fatal	Injury	PDO	Total
Base	0.03687	0.06841	0.17929	0.28456
Alternate	0.01623	0.03269	0.08778	0.13669

CROSSING DATA FOR THE EMPIRE SOUTH CORRIDOR

Milepost	46.04
Description	XMTA - MANITOU ROAD
Paved?	Yes
Urban?	No
GCX Base Type	502351L
Safety Sup. Type	None
GCX Alt Type	Lights & Gates
Safety Sup. type	Uniform

Train Speeds (mph)	
Max Timetable	80.0
Passenger	80.0
Freight	64.0
Switch	24.0

No. RR Tracks	2
H'way Lanes	2
Distance from Highway	1.0
Accidents in 5 Years	0

Highway Traffic Characteristics	*Base*	*Alternate*
AADT	167	167
Auto TOD Dist	New Techno	Uniform
Percent Trucks	11.0	11.0
Of this, % trailers	28.8	28.8
Truck TOD Dist	Uniform	Uniform
Percent Bus	0.0	0.0
Bus TOD Dist	Uniform	Uniform

Predicted Annual Accidents	*Base*	*Alternate*
Fatal	0.00543	0.00271
Injury	0.00622	0.00311
PDO	0.01462	0.00731
Total	0.28456	0.01313

Costs in '000 $	*Base*	*Alternate*
Grade Crossing Devices		
O&M	2.5	0.5
Oth. Lcycle	0.0	0.0
Capital		180.0
Supplementary Safety		
O&M	0.0	0.0
Oth. Lcycle	0.0	0.0
Capital		0.0

Milepost	47.40
Description	King's Dock
Paved?	No
Urban?	Yes
GCX Base Type	0
Safety Sup. Type	None
GCX Alt Type	Passive
Safety Sup. type	Day Flat

Train Speeds (mph)	
Max Timetable	80.0
Passenger	80.0
Freight	15.0
Switch	10.0

No. RR Tracks	2
H'way Lanes	2
Distance from Highway	0.5
Accidents in 5 Years	0

Highway Traffic Characteristics	*Base*	*Alternate*
AADT	2	2
Auto TOD Dist	New Techno	Day Flat
Percent Trucks	27.4	27.4
Of this, % trailers	28.8	28.8
Truck TOD Dist	Day Flat	Day Flat
Percent Bus	0.0	0.0
Bus TOD Dist	Day Flat	Day Flat

Predicted Annual Accidents	*Base*	*Alternate*
Fatal	0.00222	0.00067
Injury	0.00314	0.00094
PDO	0.00906	0.00272
Total	0.28456	0.00433

Costs in '000 $	*Base*	*Alternate*
Grade Crossing Devices		
O&M	0.2	0.5
Oth. Lcycle	0.0	0.0
Capital		180.0
Supplementary Safety		
O&M	0.0	0.0
Oth. Lcycle	0.0	0.0
Capital		0.0

CROSSING DATA FOR THE EMPIRE SOUTH CORRIDOR

Milepost	62.55
Description	Bank St.
Paved?	Yes
Urban?	Yes
GCX Base Type	0
Safety Sup. Type	None
GCX Alt Type	Lights & Gates
Safety Sup. type	PM Peak

Train Speeds (mph)	
Max Timetable	80.0
Passenger	80.0
Freight	15.0
Switch	10.0

No. RR Tracks	2
H'way Lanes	2
Distance from Highway	0.5
Accidents in 5 Years	0

Highway Traffic Characteristics	*Base*	*Alternate*
AADT	281	281
Auto TOD Dist	Grade Separ	PM Peak
Percent Trucks	27.4	27.4
Of this, % trailers	28.8	28.8
Truck TOD Dist	PM Peak	PM Peak
Percent Bus	0.0	0.0
Bus TOD Dist	PM Peak	PM Peak

Predicted Annual Accidents	*Base*	*Alternate*
Fatal	0.00481	0.00000
Injury	0.00681	0.00000
PDO	0.01961	0.00000
Total	0.28456	0.00000

Costs in '000 $	*Base*	*Alternate*
Grade Crossing Devices		
O&M	2.5	0.5
Oth. Lcycle	0.0	0.0
Capital		1,500.0
Supplementary Safety		
O&M	0.0	0.0
Oth. Lcycle	0.0	0.0
Capital		0.0

Milepost	71.00
Description	Pirate Canoe
Paved?	Yes
Urban?	Yes
GCX Base Type	0
Safety Sup. Type	None
GCX Alt Type	Lights & Gates
Safety Sup. type	Day Flat

Train Speeds (mph)	
Max Timetable	90.0
Passenger	90.0
Freight	15.0
Switch	10.0

No. RR Tracks	2
H'way Lanes	2
Distance from Highway	0.5
Accidents in 5 Years	1

Highway Traffic Characteristics	*Base*	*Alternate*
AADT	50	50
Auto TOD Dist	New Techno	Day Flat
Percent Trucks	27.4	27.4
Of this, % trailers	28.8	28.8
Truck TOD Dist	Day Flat	Day Flat
Percent Bus	0.0	0.0
Bus TOD Dist	Day Flat	Day Flat

Predicted Annual Accidents	*Base*	*Alternate*
Fatal	0.01103	0.00552
Injury	0.01372	0.00686
PDO	0.04013	0.02006
Total	0.28456	0.03244

Costs in '000 $	*Base*	*Alternate*
Grade Crossing Devices		
O&M	2.5	0.5
Oth. Lcycle	0.0	0.0
Capital		180.0
Supplementary Safety		
O&M	0.0	0.0
Oth. Lcycle	0.0	0.0
Capital		0.0

Milepost	75.95
Description	Captains 3
Paved?	Yes
Urban?	Yes
GCX Base Type	0
Safety Sup. Type	None
GCX Alt Type	Lights & Gates
Safety Sup. type	Day Flat

Train Speeds (mph)	
Max Timetable	90.0
Passenger	90.0
Freight	15.0
Switch	10.0

No. RR Tracks	2
H'way Lanes	2
Distance from Highway	0.5
Accidents in 5 Years	0

Highway Traffic Characteristics	*Base*	*Alternate*
AADT	50	50
Auto TOD Dist	New Techno	Day Flat
Percent Trucks	27.4	27.4
Of this, % trailers	28.8	28.8
Truck TOD Dist	Day Flat	Day Flat
Percent Bus	0.0	0.0
Bus TOD Dist	Day Flat	Day Flat

Predicted Annual Accidents	*Base*	*Alternate*
Fatal	0.00359	0.00180
Injury	0.00447	0.00223
PDO	0.01307	0.00653
Total	0.28456	0.01056

Costs in '000 $	*Base*	*Alternate*
Grade Crossing Devices		
O&M	2.5	0.5
Oth. Lcycle	0.0	0.0
Capital		180.0
Supplementary Safety		
O&M	0.0	0.0
Oth. Lcycle	0.0	0.0
Capital		0.0

FEDERAL RAILROAD ADMINISTRATION

GRADEDEC 2000 - CORRIDOR MODEL WITH HSR

CORRIDOR DATA

Corridor ID	3	Average Number of Passenger Trains / Day	68.0
Corridor Name	Empire South	Average Number of Freight Trains / Day	0.0
Rail Traffic Time-of-Day Dist		Average Number of Switch Trains / Day	0.0
Technology Factor	0.50	Signal Synchronization?	No

CORRIDOR SUMMARY OF ANNUAL PREDICTED OCCURENCES

	Accidents	Fatalities			Injuries		
		On Trains	On Highways	Total	On Trains	On Highways	Total
Base Case	0.12826	0.18139	0.05270	0.23409	0.05649	0.09692	0.15341
Alt. Case	0.04765	0.08830	0.02019	0.10849	0.02113	0.03982	0.06095

CROSSING DATA FOR THE EMPIRE SOUTH CORRIDOR

Milepost:	46.04
Description	XMTA - MANITOU ROA
Paved?	Yes
Urban?	No
GCX Base Type	502351L
Safety supp.	None
GCX Alt Type	Lights & Gates
Safety supp.	Uniform

Costs in '000 $	*Base*	*Alt.*
O&M	2.5	0.5
Other L'cycle	0.0	0.0
Capital Cost		180.0

Highway Traffic Characteristics	*Base*	*Alt.*
AADT	167	167
Auto TOD Dist	New Techn	Uniform
Percent Trucks	11.0	11.00
of these, % trailers	28.8	28.80
Truck TOD Dist	Uniform	Uniform
Percent Bus	0.00	0.00
Bus TiOD Dist	Uniform	Uniform

No. RR Tracks	2
Train speed, pass.	80.0
Train speed, freight	64.0
Train speed, switch	24.0

H'way Lanes	2
Distance from H'way	1.0

Predicted Annual Occurences	*Base*	*Alt.*
Fatalities		
on highway	0.02190	0.00548
on train	0.00157	0.00039
Total	0.02348	0.00587
Injuries		
on highway	0.03942	0.00986
on train	0.00283	0.00071
Total	0.04226	0.01056
No. Accidents	0.04082	0.01021

Milepost:	47.40
Description	King's Dock
Paved?	No
Urban?	Yes
GCX Base Type	0
Safety supp.	None
GCX Alt Type	Passive
Safety supp.	Day Flat

Costs in '000 $	*Base*	*Alt.*
O&M	0.2	0.5
Other L'cycle	0.0	0.0
Capital Cost		180.0

Highway Traffic Characteristics	*Base*	*Alt.*
AADT	2	2
Auto TOD Dist	New Techn	Day Flat
Percent Trucks	27.4	27.40
of these, % trailers	28.8	28.80
Truck TOD Dist	Day Flat	Day Flat
Percent Bus	0.00	0.00
Bus TiOD Dist	Day Flat	Day Flat

No. RR Tracks	2
Train speed, pass.	80.0
Train speed, freight	15.0
Train speed, switch	10.0

H'way Lanes	2
Distance from H'way	0.5

Predicted Annual Occurences	*Base*	*Alt.*
Fatalities		
on highway	0.00999	0.00154
on train	0.00106	0.00016
Total	0.01104	0.00170
Injuries		
on highway	0.01797	0.00277
on train	0.00190	0.00029
Total	0.01987	0.00306
No. Accidents	0.01976	0.00304

CROSSING DATA FOR THE EMPIRE SOUTH CORRIDOR

Milepost:	62.55				H'way Lanes	2	
Description	Bank St.		Base	Alt.	Distance from H'way	0.5	
Paved?	Yes	AADT	281	281			
Urban?	Yes	Auto TOD Dist	Grade Sep	PM Peak	Predicted Annual Occurences		
GCX Base Type	0	Percent Trucks	27.4	27.40		Base	Alt.
Safety supp.	None	of these, % trailers	28.8	28.80	Fatalities		
GCX Alt Type	Lights & Gates	Truck TOD Dist	PM Peak	PM Peak	on highway	0.02569	0.00000
Safety supp.	PM Peak	Percent Bus	0.00	0.00	on train	0.00272	0.00000
		Bus TiOD Dist	PM Peak	PM Peak	Total	0.02841	0.00000
Costs in '000 $					Injuries		
	Base / Alt.	No. RR Tracks		2	on highway	0.04625	0.00000
O&M	2.5 / 0.5	Train speed, pass.		80.0	on train	0.00489	0.00000
Other L'cycle	0.0 / 0.0	Train speed, freight		15.0	Total	0.05114	0.00000
Capital Cost	1,500.0	Train speed, switch		10.0	No. Accidents	0.05085	0.00000

Highway Traffic Characteristics

Milepost:	71.00				H'way Lanes	2	
Description	Pirate Canoe		Base	Alt.	Distance from H'way	0.5	
Paved?	Yes	AADT	50	50			
Urban?	Yes	Auto TOD Dist	New Techn	Day Flat	Predicted Annual Occurences		
GCX Base Type	0	Percent Trucks	27.4	27.40		Base	Alt.
Safety supp.	None	of these, % trailers	28.8	28.80	Fatalities		
GCX Alt Type	Lights & Gates	Truck TOD Dist	Day Flat	Day Flat	on highway	0.01584	0.00396
Safety supp.	Day Flat	Percent Bus	0.00	0.00	on train	0.00211	0.00053
		Bus TiOD Dist	Day Flat	Day Flat	Total	0.01794	0.00449
Costs in '000 $					Injuries		
	Base / Alt.	No. RR Tracks		2	on highway	0.02850	0.00713
O&M	2.5 / 0.5	Train speed, pass.		90.0	on train	0.00379	0.00095
Other L'cycle	0.0 / 0.0	Train speed, freight		15.0	Total	0.03230	0.00807
Capital Cost	180.0	Train speed, switch		10.0	No. Accidents	0.03134	0.00784

Highway Traffic Characteristics

Milepost:	75.95				H'way Lanes	2	
Description	Captains 3		Base	Alt.	Distance from H'way	0.5	
Paved?	Yes	AADT	50	50			
Urban?	Yes	Auto TOD Dist	New Techn	Day Flat	Predicted Annual Occurences		
GCX Base Type	0	Percent Trucks	27.4	27.40		Base	Alt.
Safety supp.	None	of these, % trailers	28.8	28.80	Fatalities		
GCX Alt Type	Lights & Gates	Truck TOD Dist	Day Flat	Day Flat	on highway	0.01584	0.00396
Safety supp.	Day Flat	Percent Bus	0.00	0.00	on train	0.00211	0.00053
		Bus TiOD Dist	Day Flat	Day Flat	Total	0.01794	0.00449
Costs in '000 $					Injuries		
	Base / Alt.	No. RR Tracks		2	on highway	0.02850	0.00713
O&M	2.5 / 0.5	Train speed, pass.		90.0	on train	0.00379	0.00095
Other L'cycle	0.0 / 0.0	Train speed, freight		15.0	Total	0.03230	0.00807
Capital Cost	180.0	Train speed, switch		10.0	No. Accidents	0.03134	0.00784

Highway Traffic Characteristics

FEDERAL RAILROAD ADMINISTRATION

GRADEDEC 2000 - REGIONAL MODEL

REGION

Region ID	3
Region Name	Montgomery County, Maryland
Technology Factor	0.50
Percent Benefit from Closure	10.00

SUMMARY OF PREDICTED ACCIDENTS FOR CROSSINGS IN THE REGION

	Fatal	Injury	PDO	Total
Base	0.18075	0.72531	1.55905	2.46512
Alternate	0.05881	0.27789	0.59251	0.92921

CROSSING DATA FOR THE REGION

Crossing ID	140488D
Milepost:	000971
Description	CSX - FOREST GLEN RD
Paved?	True
Urban?	True
GCX Base Type	Gates
Supp. Safety	None
GCX Alt Type	New technology
Supp. Safety	None
H'way Lanes	2
No. Main Tracks	2
No. Other Tracks	0

Train Speeds (mph)	
Thru	55.0
Switch	16.5
Max TT Speed	55.0
Day Through	14.0
Night Through	22.0
Day Switch	0.0
Night Switch	0.0
Rail TOD	Unifor

Accidents Past Years			
Yr 1	0	Yr 2	0
Yr 3	0	Yr 4	0
Yr 5	0		

Highway Traffic Characteristics	*Base*	*Alternate*
AADT	11400	11400
Auto TOD	Uniform	Uniform
% Trucks	3.00	3.00
Truck TOD	Uniform	Uniform
% Bus	0.00	0.00
Bus TOD	Uniform	Uniform

Predicted Annual Accidents	*Base*	*Alternate*
Fatal	0.00732	0.00366
Injury	0.01347	0.00673
PDO	0.02967	0.01483

Costs in '000 $	*Base*	*Alternate*
Grade Crosisng Devices		
O&M	2.5	0.5
Other	0.0	0.0
Capital		0.0
Supplementary Safety		
O&M	0.0	0.0
Other	0.0	0.0
Capital		0.0

Crossing ID	140494G
Milepost:	001377
Description	CSX - RANDOLPH ROAD
Paved?	True
Urban?	True
GCX Base Type	Gates
Supp. Safety	None
GCX Alt Type	Grade separation
Supp. Safety	None
H'way Lanes	4
No. Main Tracks	2
No. Other Tracks	0

Train Speeds (mph)	
Thru	79.0
Switch	23.7
Max TT Speed	79.0
Day Through	19.0
Night Through	10.0
Day Switch	0.0
Night Switch	0.0
Rail TOD	Unifor

Accidents Past Years			
Yr 1	0	Yr 2	1
Yr 3	0	Yr 4	0
Yr 5	1		

Highway Traffic Characteristics	*Base*	*Alternate*
AADT	41000	41000
Auto TOD	Uniform	Uniform
% Trucks	9.00	9.00
Truck TOD	Uniform	Uniform
% Bus	0.00	0.00
Bus TOD	Uniform	Uniform

Predicted Annual Accidents	*Base*	*Alternate*
Fatal	0.04644	0.00000
Injury	0.06004	0.00000
PDO	0.13424	0.00000

Costs in '000 $	*Base*	*Alternate*
Grade Crosisng Devices		
O&M	2.5	0.5
Other	0.0	0.0
Capital		1,500.0
Supplementary Safety		
O&M	0.0	0.0
Other	0.0	0.0
Capital		0.0

Crossing ID	140505S
Milepost:	002050
Description	CSX - RIDGE RD.
Paved?	True
Urban?	True
GCX Base Type	Gates
Supp. Safety	None
GCX Alt Type	New technology
Supp. Safety	None
H'way Lanes	2
No. Main Tracks	2
No. Other Tracks	0

Train Speeds (mph)	
Thru	79.0
Switch	23.7
Max TT Speed	79.0
Day Through	14.0
Night Through	22.0
Day Switch	0.0
Night Switch	0.0
Rail TOD	Unifor

Accidents Past Years			
Yr 1	0	Yr 2	0
Yr 3	0	Yr 4	0
Yr 5	0		

Highway Traffic Characteristics	*Base*	*Alternate*
AADT	4000	4000
Auto TOD	Uniform	Uniform
% Trucks	4.00	4.00
Truck TOD	Uniform	Uniform
% Bus	0.00	0.00
Bus TOD	Uniform	Uniform

Predicted Annual Accidents	*Base*	*Alternate*
Fatal	0.00806	0.00403
Injury	0.01015	0.00508
PDO	0.02296	0.01148

Costs in '000 $	*Base*	*Alternate*
Grade Crosisng Devices		
O&M	2.5	0.5
Other	0.0	0.0
Capital		0.0
Supplementary Safety		
O&M	0.0	0.0
Other	0.0	0.0
Capital		0.0

CROSSING DATA FOR THE REGION

Crossing ID	140507F	Train Speeds (mph)		Highway Traffic Characteristics				Costs in '000 $		
Milepost:	002179	Thru	79.0		Base	Alternate			Base	Alternate
Description	CSX - S SUMMIT AVE	Switch	23.7	AADT	15000	15000		Grade Crosisng Devices		
		Max TT Speed	79.0	Auto TOD	Uniform	Uniform		O&M	2.5	0.5
Paved?	True	Day Through	14.0	% Trucks	5.00	5.00		Other	0.0	0.0
Urban?	True	Night Through	22.0	Truck TOD	Uniform	Uniform		Capital		0.0
GCX Base Type	Gates	Day Switch	0.0	% Bus	0.00	0.00		Supplementary Safety		
Supp. Safety	None	Night Switch	0.0	Bus TOD	Uniform	Uniform		O&M	0.0	0.0
GCX Alt Type	New technology	Rail TOD	Unifor	Predicted Annual Accidents				Other	0.0	0.0
Supp. Safety	None	Accidents Past Years			Base	Alternate		Capital		0.0
H'way Lanes	3	Yr 1 0	Yr 2 0	Fatal	0.01128	0.00564				
No. Main Tracks	2	Yr 3 0	Yr 4 0	Injury	0.01421	0.00710				
No. Other Tracks	0	Yr 5 0		PDO	0.03214	0.01607				

Crossing ID	140509U	Train Speeds (mph)		Highway Traffic Characteristics			Costs in '000 $		
Milepost:	002213	Thru	65.0		Base	Alternate		Base	Alternate
Description	CSX - CHESTNUT ST.	Switch	19.5	AADT	10500	10500	Grade Crosisng Devices		
		Max TT Speed	65.0	Auto TOD	Uniform	Uniform	O&M	2.5	0.5
Paved?	True	Day Through	14.0	% Trucks	4.00	4.00	Other	0.0	0.0
Urban?	True	Night Through	22.0	Truck TOD	Uniform	Uniform	Capital		0.0
GCX Base Type	Gates	Day Switch	0.0	% Bus	0.00	0.00	Supplementary Safety		
Supp. Safety	None	Night Switch	0.0	Bus TOD	Uniform	Uniform	O&M	0.0	0.0
GCX Alt Type	New technology	Rail TOD	Unifor	Predicted Annual Accidents			Other	0.0	0.0
Supp. Safety	None	Accidents Past Years			Base	Alternate	Capital		0.0
H'way Lanes	2	Yr 1 0	Yr 2 0	Fatal	0.00829	0.00415			
No. Main Tracks	2	Yr 3 0	Yr 4 0	Injury	0.01287	0.00643			
No. Other Tracks	0	Yr 5 0		PDO	0.02853	0.01426			

Crossing ID	140512C	Train Speeds (mph)		Highway Traffic Characteristics			Costs in '000 $		
Milepost:	002336	Thru	79.0		Base	Alternate		Base	Alternate
Description	CSX - METROPOLITANGROV E	Switch	23.7	AADT	50	50	Grade Crosisng Devices		
		Max TT Speed	79.0	Auto TOD	Uniform	Uniform	O&M	2.5	0.5
Paved?	True	Day Through	14.0	% Trucks	40.00	40.00	Other	0.0	0.0
Urban?	True	Night Through	22.0	Truck TOD	Uniform	Uniform	Capital		0.0
GCX Base Type	Gates	Day Switch	0.0	% Bus	0.00	0.00	Supplementary Safety		
Supp. Safety	None	Night Switch	0.0	Bus TOD	Uniform	Uniform	O&M	0.0	0.0
GCX Alt Type	New technology	Rail TOD	Unifor	Predicted Annual Accidents			Other	0.0	0.0
Supp. Safety	None	Accidents Past Years			Base	Alternate	Capital		0.0
H'way Lanes	1	Yr 1 0	Yr 2 0	Fatal	0.00978	0.00489			
No. Main Tracks	2	Yr 3 1	Yr 4 0	Injury	0.01232	0.00616			
No. Other Tracks	0	Yr 5 0		PDO	0.02786	0.01393			

CROSSING DATA FOR THE REGION

Crossing ID	140519A	Train Speeds (mph)		Highway Traffic Characteristics			Costs in '000 $	
Milepost:	003310	Thru	79.0		Base	Alternate	Base	Alternate
Description	CSX - HILLRISE LANE	Switch	23.7	AADT	10	10	Grade Crosisng Devices	
		Max TT Speed	79.0	Auto TOD	Uniform	Uniform	O&M 0.2	1.8
Paved?	True	Day Through	14.0	% Trucks	1.00	1.00	Other 0.0	0.0
Urban?	True	Night Through	22.0	Truck TOD	Uniform	Uniform	Capital	0.0
GCX Base Type	Crossbucks	Day Switch	0.0	% Bus	0.00	0.00	Supplementary Safety	
Supp. Safety	None	Night Switch	0.0	Bus TOD	Uniform	Uniform	O&M 0.0	0.0
GCX Alt Type	Flashing lights	Rail TOD	Unifor	Predicted Annual Accidents			Other 0.0	0.0
Supp. Safety	None	Accidents Past Years			Base	Alternate	Capital	0.0
H'way Lanes	1	Yr 1 0	Yr 2 0	Fatal	0.00844	0.00363		
No. Main Tracks	2	Yr 3 0	Yr 4 0	Injury	0.01062	0.00457		
No. Other Tracks	0	Yr 5 0		PDO	0.02403	0.01033		

Crossing ID	140524W	Train Speeds (mph)		Highway Traffic Characteristics			Costs in '000 $	
Milepost:	003700	Thru	60.0		Base	Alternate	Base	Alternate
Description	CSX - MOUTHOFMONOCACY RD	Switch	18.0	AADT	400	400	Grade Crosisng Devices	
		Max TT Speed	60.0	Auto TOD	Uniform	Uniform	O&M 0.2	1.8
Paved?	True	Day Through	0.0	% Trucks	1.00	1.00	Other 0.0	0.0
Urban?	True	Night Through	0.0	Truck TOD	Uniform	Uniform	Capital	0.0
GCX Base Type	Crossbucks	Day Switch	2.0	% Bus	0.00	0.00	Supplementary Safety	
Supp. Safety	None	Night Switch	0.0	Bus TOD	Uniform	Uniform	O&M 0.0	0.0
GCX Alt Type	Flashing lights	Rail TOD	Unifor	Predicted Annual Accidents			Other 0.0	0.0
Supp. Safety	None	Accidents Past Years			Base	Alternate	Capital	0.0
H'way Lanes	2	Yr 1 0	Yr 2 0	Fatal	0.00290	0.00102		
No. Main Tracks	0	Yr 3 0	Yr 4 0	Injury	0.00975	0.00341		
No. Other Tracks	1	Yr 5 0		PDO	0.01392	0.00487		

FEDERAL RAILROAD ADMINISTRATION

GRADEDEC 2000 – CORRIDOR MODEL – SCENARIO DATA

Scenario ID	1	First Year	2000
Description	Strong rail growth	Last Year Near Term	2004
		Last Year	2019

STRONG RAIL GROWTH SCENARIO DATA

Variable Description	Prob. Distribution Type			
Rail Operations				
Rate of growth in rail traffic, near term, %		**Lower 10%**	**Median**	**Upper 10%**
	Skewed Bell	2.60000	2.95000	3.30000
Rate of growth in traffic, long term, %		**Lower 10%**	**Median**	**Upper 10%**
	Skewed Bell	1.30000	2.00000	2.50000
Freight rail cars per train		**Mean - std**	**Mean**	**Mean + std**
	Normal	35.0000	45.0000	55.0000
Passenger rail cars per train		**Min Value**	**Most Likely**	**Max Value**
	Triangle	5.50000	6.00000	6.50000
Switch cars per train			**Fixed Value**	
	Fixed Value		5.00000	
Average length of freight rail car, feet		**Lower 10%**	**Median**	**Upper 10%**
	Skewed Bell	53.0000	55.0000	58.0000
Average length of passenger train rail car, feet		**Lower 10%**	**Median**	**Upper 10%**
	Skewed Bell	37.0000	40.0000	43.5000
Average length of switch train car, feet		**Min Value**	**Most Likely**	**Max Value**
	Triangle	60.0000	67.5000	75.0000
Highway				
Avg annual growth in hway traffic, near term, %		**Lower 10%**	**Median**	**Upper 10%**
	Skewed Bell	2.00000	2.50000	2.80000
Avg annual growth in hway traffic, long term		**Lower 10%**	**Median**	**Upper 10%**
	Skewed Bell	0.700000	1.00000	1.80000
Average auto vehicle occupancy		**Lower 10%**	**Median**	**Upper 10%**
	Skewed Bell	1.47600	1.64000	1.80400
Avg bus vehicle occupancy		**Lower 10%**	**Median**	**Upper 10%**
	Skewed Bell	9.00000	10.0000	11.0000
Annualization factor			**Fixed Value**	
	Fixed Value		280.000	
Elasticity of auto AADT w.r.t. generalized cost of travel			**Fixed Value**	
	Fixed Value		-0.100000	
Average % of auto trip costs that are GCX-related, percent			**Fixed Value**	
	Fixed Value		2.50000	

STRONG RAIL GROWTH SCENARIO DATA

Variable Description	Prob. Distribution Type			
Social Costs				
Discount rate, %			**Fixed Value**	
	Fixed Value		5.00000	
Cost of a fatal accident, thous $		**Lower 10%**	**Median**	**Upper 10%**
	Skewed Bell	3500.00	3800.00	4500.00
Cost of an injury accident, thous $		**Lower 10%**	**Median**	**Upper 10%**
	Skewed Bell	800.000	1000.00	1400.00
Cost of a property damage only accident, thous $		**Lower 10%**	**Median**	**Upper 10%**
	Skewed Bell	40.0000	50.0000	90.0000
Cost per fatality (for HSR Model), thous $		**Lower 10%**	**Median**	**Upper 10%**
	Skewed Bell	2200.00	2700.00	2900.00
Cost per injury (for HSR model), thous $		**Lower 10%**	**Median**	**Upper 10%**
	Skewed Bell	180.000	250.000	300.000
Average out-of-pocket cost per accident (for HSR model), t		**Lower 10%**	**Median**	**Upper 10%**
	Skewed Bell	110.000	140.000	180.000
Value of time for auto travel, $ / hr		**Lower 10%**	**Median**	**Upper 10%**
	Skewed Bell	9.36000	10.4000	11.4400
Value of truck driver time, $ / hr		**Lower 10%**	**Median**	**Upper 10%**
	Skewed Bell	16.2540	18.0600	19.8660
Cost of HC emissions, thous $ / ton		**Lower 10%**	**Median**	**Upper 10%**
	Skewed Bell	1.13000	2.04000	2.96000
Cost of NOX emissions, thous $ / ton		**Lower 10%**	**Median**	**Upper 10%**
	Skewed Bell	1.64000	2.76500	3.89000
Cost of CO emissions, thous $ /ton		**Lower 10%**	**Median**	**Upper 10%**
	Skewed Bell	0.0215000	0.0500000	0.107400
Base year gasoline fuel cost, $ / gal			**Fixed Value**	
	Fixed Value		1.59000	
Base year diesel fuel cost, $ / gal			**Fixed Value**	
	Fixed Value		1.43400	
Base year oil cost, $ / qt			**Fixed Value**	
	Fixed Value		3.76000	
% additional local benefits, %		**Lower 10%**	**Median**	**Upper 10%**
	Skewed Bell	3.00000	5.00000	7.00000
Price Inflation				
Fuel price inflation, year 2000, %		**Lower 10%**	**Median**	**Upper 10%**
	Skewed Bell	1.76000	3.00000	4.04000

STRONG RAIL GROWTH SCENARIO DATA

Variable Description	Prob. Distribution Type	Lower 10%	Median	Upper 10%
Fuel price inflation, year 2001, %	Skewed Bell	1.72000	3.00000	4.08000
Fuel price inflation, year 2002, %	Skewed Bell	1.69000	3.00000	4.12000
Fuel price inflation, year 2003, %	Skewed Bell	1.66000	3.00000	4.16000
Fuel price inflation, year 2004, %	Skewed Bell	1.63000	3.00000	4.20000
Fuel price inflation, year 2005, %	Skewed Bell	1.60000	3.00000	4.24000
Fuel price inflation, year 2006, %	Skewed Bell	1.57000	3.00000	4.28000
Fuel price inflation, year 2007, %	Skewed Bell	1.54000	3.00000	4.32000
Fuel price inflation, year 2008, %	Skewed Bell	1.51000	3.00000	4.36000
Fuel price inflation, year 2009, %	Skewed Bell	1.48000	3.00000	4.40000
Fuel price inflation, year 2010, %	Skewed Bell	1.45000	3.00000	4.44000
Fuel price inflation, year 2011, %	Skewed Bell	1.42000	3.00000	4.48000
Fuel price inflation, year 2012, %	Skewed Bell	1.39000	3.00000	4.52000
Fuel price inflation, year 2013, %	Skewed Bell	1.36000	3.00000	4.57000
Fuel price inflation, year 2014, %	Skewed Bell	1.33000	3.00000	4.62000
Fuel price inflation, year 2015, %	Skewed Bell	1.30000	3.00000	4.67000
Fuel price inflation, year 2016, %	Skewed Bell	1.27000	3.00000	4.72000
Fuel price inflation, year 2017, %	Skewed Bell	1.24000	3.00000	4.77000
Fuel price inflation, year 2018, %	Skewed Bell	1.22000	3.00000	4.82000
Fuel price inflation, year 2019, %	Skewed Bell	1.20000	3.00000	4.87000

STRONG RAIL GROWTH SCENARIO DATA

Variable Description	Prob. Distribution Type	Lower 10%	Median	Upper 10%
General price inflation, year 2000, %	Skewed Bell	2.20000	3.00000	3.50000
General price inflation, year 2001, %	Skewed Bell	2.00000	3.00000	3.70000
General price inflation, year 2002, %	Skewed Bell	1.80000	3.00000	3.80000
General price inflation, year 2003, %	Skewed Bell	1.50000	3.00000	3.90000
General price inflation, year 2004, %	Skewed Bell	1.40000	2.50000	4.00000
General price inflation, year 2005, %	Skewed Bell	1.30000	2.50000	4.10000
General price inflation, year 2006, %	Skewed Bell	1.20000	2.50000	4.20000
General price inflation, year 2007, %	Skewed Bell	1.10000	2.50000	4.30000
General price inflation, year 2008, %	Skewed Bell	1.10000	2.50000	4.40000
General price inflation, year 2009, %	Skewed Bell	1.00000	2.50000	4.50000
General price inflation, year 2010, %	Skewed Bell	1.00000	2.50000	4.50000
General price inflation, year 2011, %	Skewed Bell	1.00000	2.50000	4.50000
General price inflation, year 2012, %	Skewed Bell	1.00000	2.50000	4.50000
General price inflation, year 2013, %	Skewed Bell	1.00000	2.50000	4.50000
General price inflation, year 2014, %	Skewed Bell	1.00000	2.50000	4.50000
General price inflation, year 2015, %	Skewed Bell	1.00000	2.50000	4.50000
General price inflation, year 2016, %	Skewed Bell	1.00000	2.50000	4.50000
General price inflation, year 2017, %	Skewed Bell	1.00000	2.50000	4.50000
General price inflation, year 2018, %	Skewed Bell	1.00000	2.50000	4.50000

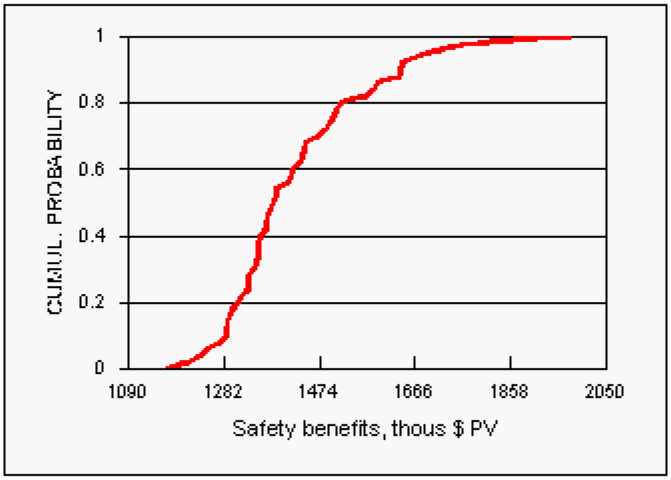
STRONG RAIL GROWTH SCENARIO DATA

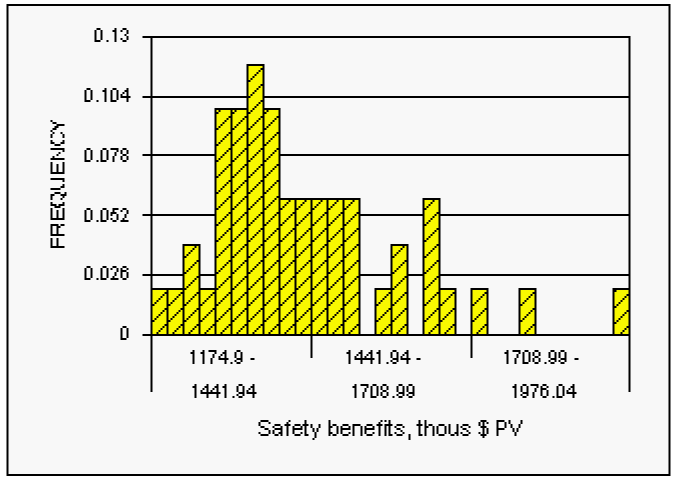
Variable Description	Prob. Distribution Type	Lower 10%	Median	Upper 10%
General price inflation, year 2019, %	Skewed Bell	1.00000	2.50000	4.50000

FEDERAL RAILROAD ADMINISTRATION

GRADEDEC 2000 - RISK ANALYSIS OF RESULT **Safety benefits, thous $ PV**

Results file:	ResC2	**Scenario ID:**	1
File description:	Rail growth, Empire South	**Scenario Description:**	Strong rail growth
Corridor ID:	3	**Number of Trials:**	51
Corridor:	Empire South	**Date/Time of Simulation:**	11/11/2001 1:22:54 PM





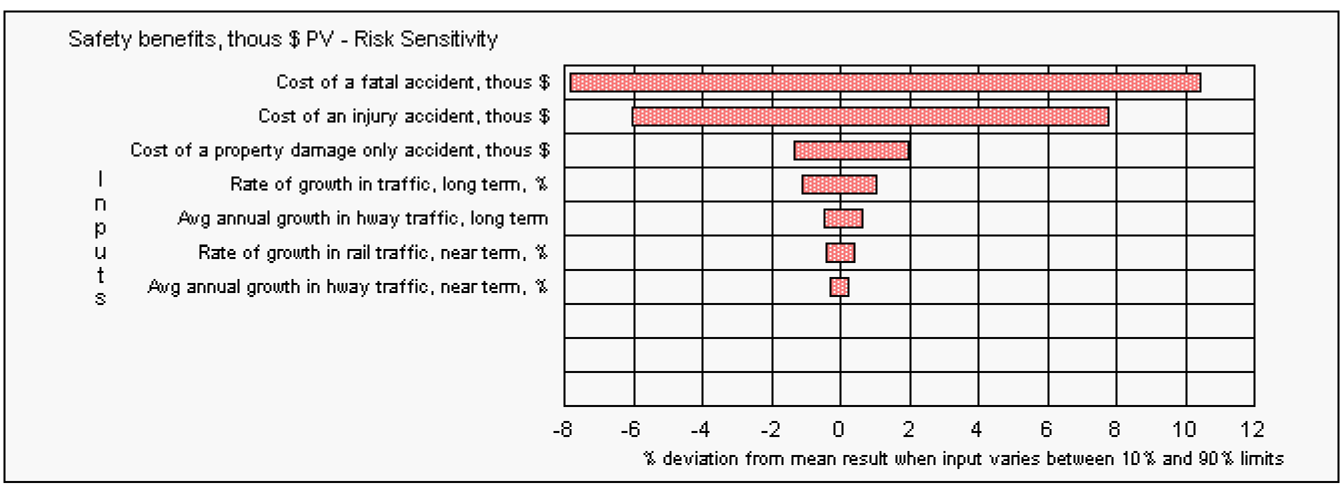
Summary Statistics
Safety benefits, thous $ PV

Mean	**1,428.22**
Standard Deviation	155.420
Minimum	1,174.90
Maximum	1,976.04
Skewness	1.26984
Kurtosis	2.12274

Percentile Summary
Safety benefits, thous $ PV

1%	1,194.41
5%	1,244.59
10%	1,289.25
20%	1,310.92
30%	1,343.08
40%	1,358.07
50%	1,383.57
60%	1,421.38
70%	1,472.16
80%	1,519.30
90%	1,637.99
95%	1,694.63
99%	1,884.27

80% CONFIDENCE



FEDERAL RAILROAD ADMINISTRATION

GRADEDEC 2000 - RISK ANALYSIS RESULTS

Results file: ResC2.mdb Rail growth, Empire South	**Number of Trials:** 51
Corridor: 3 Empire South	**Random Seed:** 1
Scenario: 1 Strong rail growth	**Date/Time of Simulation:** 11/11/2001 1:22:54 PM

Result No.: **Result Variable Description** **Percentile Summary** **Summary Statistics**

1 ***Safety benefits, thous $ PV***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	1,194	*1,245*	*1,289*	*1,311*	*1,343*	*1,358*	1,428	155.42	1.2698	2.1227
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**	**Maximum**	
1,384	*1,421*	*1,472*	*1,519*	*1,638*	*1,695*	*1,884*		1,175	1,976	

2 ***Travel time savings, thous $ PV***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	3.8965	*4.0656*	*4.1574*	*4.4329*	*4.6311*	*4.7324*	4.8898	.52404	.05305	-.59993
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**	**Maximum**	
4.8763	*5.0724*	*5.2394*	*5.3072*	*5.4951*	*5.8197*	*5.9296*		3.8672	5.9816	

3 ***Environmental benefits, thous $ PV***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	.01418	*.01565*	*.01841*	*.02049*	*.02228*	*.02375*	.02547	.00597	.12822	-.48985
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**	**Maximum**	
.02532	*.02644*	*.02952*	*.03040*	*.03236*	*.03577*	*.03804*		.01407	.03815	

4 ***Veh operating cost benefit, thous $ PV***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	.31560	*.33380*	*.34484*	*.36172*	*.37129*	*.37783*	.38409	.03076	.00795	.65099
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**	**Maximum**	
.38589	*.39253*	*.39664*	*.40557*	*.41644*	*.43120*	*.45670*		.30719	.46811	

5 ***Network benefits, thous $ PV***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	0.0	0.0	0.0	-3.0000
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**	**Maximum**	
0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*		0.0	0.0	

6 ***Total benefits, thous $ PV***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	1,200	*1,251*	*1,295*	*1,318*	*1,348*	*1,364*	1,434	155.59	1.2666	2.1114
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**	**Maximum**	
1,389	*1,428*	*1,478*	*1,526*	*1,644*	*1,701*	*1,891*		1,180	1,982	

Result No.:	Result Variable Description	Percentile Summary						Summary Statistics			
7	***of this, benefits from induced trips, thous $ PV***										
	1%	***5%***	***10%***	***20%***	***30%***	***40%***		**Mean**	**Std Dev**	**Skewness**	**Kurtosis**
	.74305	*.77495*	*.80254*	*.81769*	*.83659*	*.84642*		.88928	.09660	1.2497	2.0277
50%	***60%***	***70%***	***80%***	***90%***	***95%***	***99%***		**Minimum**		**Maximum**	
.86063	*.88584*	*.91656*	*.94708*	*1.0199*	*1.0568*	*1.1709*		.73095		1.2270	
8	***of this, disbenefits from induced trips, thous $ PV***										
	1%	***5%***	***10%***	***20%***	***30%***	***40%***		**Mean**	**Std Dev**	**Skewness**	**Kurtosis**
	-.00176	*-.00165*	*-.00149*	*-.00142*	*-.00136*	*-.00122*		-.00117	.00028	-.18055	-.51510
50%	***60%***	***70%***	***80%***	***90%***	***95%***	***99%***		**Minimum**		**Maximum**	
-.00116	*-.00108*	*-.00101*	*-.00094*	*-.00083*	*-.00071*	*-.00066*		-.00177		-.00064	
9	***Total costs, thous $ PV***										
	1%	***5%***	***10%***	***20%***	***30%***	***40%***		**Mean**	**Std Dev**	**Skewness**	**Kurtosis**
	2,230	*2,230*	*2,230*	*2,230*	*2,230*	*2,230*		2,230	0.0	0.0	-3.0000
50%	***60%***	***70%***	***80%***	***90%***	***95%***	***99%***		**Minimum**		**Maximum**	
2,230	*2,230*	*2,230*	*2,230*	*2,230*	*2,230*	*2,230*		2,230		2,230	
10	***Net benefits, thous $ PV***										
	1%	***5%***	***10%***	***20%***	***30%***	***40%***		**Mean**	**Std Dev**	**Skewness**	**Kurtosis**
	-1,030	*-979.71*	*-935.07*	*-912.06*	*-881.89*	*-865.89*		-795.84	155.59	1.2666	2.1114
50%	***60%***	***70%***	***80%***	***90%***	***95%***	***99%***		**Minimum**		**Maximum**	
-841.15	*-802.34*	*-752.14*	*-704.47*	*-586.67*	*-529.21*	*-339.68*		-1,050		-247.90	
11	***Benefit-cost ratio***										
	1%	***5%***	***10%***	***20%***	***30%***	***40%***		**Mean**	**Std Dev**	**Skewness**	**Kurtosis**
	.53796	*.56071*	*.58073*	*.59105*	*.60458*	*.61175*		.64316	.06977	1.2666	2.1114
50%	***60%***	***70%***	***80%***	***90%***	***95%***	***99%***		**Minimum**		**Maximum**	
.62284	*.64025*	*.66275*	*.68413*	*.73695*	*.76271*	*.84770*		.52931		.88885	
12	***Rate of return (constant dollars), %***										
	1%	***5%***	***10%***	***20%***	***30%***	***40%***		**Mean**	**Std Dev**	**Skewness**	**Kurtosis**
	-1.4692	*-1.0357*	*-.74488*	*-.54626*	*-.39854*	*-.22205*		.20293	1.0224	1.0800	1.5304
50%	***60%***	***70%***	***80%***	***90%***	***95%***	***99%***		**Minimum**		**Maximum**	
-.10112	*.20181*	*.49897*	*.80930*	*1.6135*	*1.9491*	*3.0798*		-1.6335		3.6229	
13	***Local benefits (not included in summary), thous $ PV***										
	1%	***5%***	***10%***	***20%***	***30%***	***40%***		**Mean**	**Std Dev**	**Skewness**	**Kurtosis**
	22.980	*38.704*	*43.969*	*52.609*	*61.952*	*66.373*		71.455	22.876	.26522	.82396
50%	***60%***	***70%***	***80%***	***90%***	***95%***	***99%***		**Minimum**		**Maximum**	
69.272	*73.745*	*80.868*	*90.773*	*100.75*	*107.25*	*125.90*		12.658		138.35	

Result No.:	Result Variable Description	Percentile Summary						Summary Statistics			

14 — ***Safety Benefit, GCX 1, thous $ PV, MP 46.04***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	176.62	184.17	189.64	193.11	197.02	200.15	210.42	23.092	1.4401	3.0122
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
203.34	210.22	216.72	223.47	239.86	247.05	281.53		173.69		297.15

15 — ***Safety Benefit, GCX 2, thous $ PV, MP 47.4***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	110.72	116.49	120.27	122.87	125.77	127.70	134.06	14.863	1.1568	1.5942
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
129.71	134.28	137.72	143.46	154.57	161.57	175.70		108.71		183.84

16 — ***Safety Benefit, GCX 3, thous $ PV, MP 62.55***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	330.65	345.01	357.30	365.55	371.97	379.34	397.05	43.250	1.1623	1.5991
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
383.74	396.49	409.87	426.33	453.94	477.04	519.24		325.10		541.92

17 — ***Safety Benefit, GCX 4, thous $ PV, MP 71***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	455.88	473.01	490.55	496.28	510.61	515.90	542.33	58.617	1.3116	2.3194
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
526.90	538.28	559.47	575.22	620.22	641.04	716.74		448.88		752.25

18 — ***Safety Benefit, GCX 5, thous $ PV, MP 75.95***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	120.54	125.91	130.32	132.50	134.96	137.23	144.35	15.801	1.3055	2.3015
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
139.49	143.62	148.37	152.77	166.29	171.05	191.08		118.51		200.87

19 — ***Travel Time Savings, GCX 1, thous $ PV, MP 46.04***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0000
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0		0.0

20 — ***Travel Time Savings, GCX 2, thous $ PV, MP 47.4***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0000
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0		0.0

Result No.:	Result Variable Description	Percentile Summary	Summary Statistics

21 ***Travel Time Savings, GCX 3, thous $ PV, MP 62.55***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	3.8906	4.0595	4.1511	4.4262	4.6241	4.7253	4.8825	.52325	.05305	-.59992
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
4.8690	5.0648	5.2315	5.2992	5.4868	5.8110	5.9206		3.8614		5.9726

22 ***Travel Time Savings, GCX 4, thous $ PV, MP 71***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	.00586	.00612	.00626	.00667	.00697	.00712	.00736	.00079	.05019	-.60410
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
.00734	.00764	.00789	.00799	.00827	.00876	.00892		.00582		.00900

23 ***Travel Time Savings, GCX 5, thous $ PV, MP 75.95***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0000
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0		0.0

24 ***Environmental Benefit, GCX 1, thous $ PV, MP 46.04***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0000
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0		0.0

25 ***Environmental Benefit, GCX 2, thous $ PV, MP 47.4***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0000
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0		0.0

26 ***Environmental Benefit, GCX 3, thous $ PV, MP 62.55***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	.01416	.01562	.01839	.02046	.02225	.02371	.02543	.00597	.12822	-.48985
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
.02528	.02640	.02948	.03036	.03231	.03571	.03799		.01405		.03809

27 ***Environmental Benefit, GCX 4, thous $ PV, MP 71***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	.00002	.00002	.00003	.00003	.00003	.00004	.00004	.00001	.12824	-.48915
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
.00004	.00004	.00004	.00005	.00005	.00005	.00006		.00002		.00006

Result No.:	Result Variable Description			Percentile Summary				Summary Statistics			
28	*Environmental Benefit, GCX 5, thous $ PV, MP 75.95*										
	1%	***5%***	***10%***	***20%***	***30%***	***40%***		**Mean**	**Std Dev**	**Skewness**	**Kurtosis**
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*		0.0	0.0	0.0	-3.0000
50%	***60%***	***70%***	***80%***	***90%***	***95%***	***99%***			**Minimum**	**Maximum**	
0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*			0.0	0.0	
29	*Benefit Veh Op Cost, GCX 1, thous $ PV, MP 46.04*										
	1%	***5%***	***10%***	***20%***	***30%***	***40%***		**Mean**	**Std Dev**	**Skewness**	**Kurtosis**
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*		0.0	0.0	0.0	-3.0000
50%	***60%***	***70%***	***80%***	***90%***	***95%***	***99%***			**Minimum**	**Maximum**	
0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*			0.0	0.0	
30	*Benefit Veh Op Cost, GCX 2, thous $ PV, MP 47.4*										
	1%	***5%***	***10%***	***20%***	***30%***	***40%***		**Mean**	**Std Dev**	**Skewness**	**Kurtosis**
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*		0.0	0.0	0.0	-3.0000
50%	***60%***	***70%***	***80%***	***90%***	***95%***	***99%***			**Minimum**	**Maximum**	
0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*			0.0	0.0	
31	*Benefit Veh Op Cost, GCX 3, thous $ PV, MP 62.55*										
	1%	***5%***	***10%***	***20%***	***30%***	***40%***		**Mean**	**Std Dev**	**Skewness**	**Kurtosis**
	.31513	*.33330*	*.34432*	*.36118*	*.37073*	*.37726*		.38351	.03071	.00796	.65100
50%	***60%***	***70%***	***80%***	***90%***	***95%***	***99%***			**Minimum**	**Maximum**	
.38531	*.39194*	*.39604*	*.40496*	*.41581*	*.43056*	*.45601*			.30673	.46741	
32	*Benefit Veh Op Cost, GCX 4, thous $ PV, MP 71*										
	1%	***5%***	***10%***	***20%***	***30%***	***40%***		**Mean**	**Std Dev**	**Skewness**	**Kurtosis**
	.00048	*.00050*	*.00052*	*.00054*	*.00056*	*.00057*		.00058	.00005	.00315	.64047
50%	***60%***	***70%***	***80%***	***90%***	***95%***	***99%***			**Minimum**	**Maximum**	
.00058	*.00059*	*.00060*	*.00061*	*.00063*	*.00065*	*.00069*			.00046	.00070	
33	*Benefit Veh Op Cost, GCX 5, thous $ PV, MP 75.95*										
	1%	***5%***	***10%***	***20%***	***30%***	***40%***		**Mean**	**Std Dev**	**Skewness**	**Kurtosis**
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*		0.0	0.0	0.0	-3.0000
50%	***60%***	***70%***	***80%***	***90%***	***95%***	***99%***			**Minimum**	**Maximum**	
0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*			0.0	0.0	
34	*Network Benefits, GCX 1, thous $ PV, MP 46.04*										
	1%	***5%***	***10%***	***20%***	***30%***	***40%***		**Mean**	**Std Dev**	**Skewness**	**Kurtosis**
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*		0.0	0.0	0.0	-3.0000
50%	***60%***	***70%***	***80%***	***90%***	***95%***	***99%***			**Minimum**	**Maximum**	
0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*			0.0	0.0	

Result No.:	Result Variable Description	Percentile Summary	Summary Statistics

35 ***Network Benefits, GCX 2, thous $ PV, MP 47.4***

	1%	5%	10%	20%	30%	40%
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**
0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Mean	Std Dev	Skewness	Kurtosis
0.0	0.0	0.0	-3.0000
Minimum		**Maximum**	
0.0		0.0	

36 ***Network Benefits, GCX 3, thous $ PV, MP 62.55***

	1%	5%	10%	20%	30%	40%
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**
0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Mean	Std Dev	Skewness	Kurtosis
0.0	0.0	0.0	-3.0000
Minimum		**Maximum**	
0.0		0.0	

37 ***Network Benefits, GCX 4, thous $ PV, MP 71***

	1%	5%	10%	20%	30%	40%
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**
0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Mean	Std Dev	Skewness	Kurtosis
0.0	0.0	0.0	-3.0000
Minimum		**Maximum**	
0.0		0.0	

38 ***Network Benefits, GCX 5, thous $ PV, MP 75.95***

	1%	5%	10%	20%	30%	40%
	0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**
0.0	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*	*0.0*

Mean	Std Dev	Skewness	Kurtosis
0.0	0.0	0.0	-3.0000
Minimum		**Maximum**	
0.0		0.0	

39 ***Total Benefits, GCX 1, thous $ PV, MP 46.04***

	1%	5%	10%	20%	30%	40%
	176.62	*184.17*	*189.64*	*193.11*	*197.02*	*200.15*
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**
203.34	*210.22*	*216.72*	*223.47*	*239.86*	*247.05*	*281.53*

Mean	Std Dev	Skewness	Kurtosis
210.42	23.092	1.4401	3.0122
Minimum		**Maximum**	
173.69		297.15	

40 ***Total Benefits, GCX 2, thous $ PV, MP 47.4***

	1%	5%	10%	20%	30%	40%
	110.72	*116.49*	*120.27*	*122.87*	*125.77*	*127.70*
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**
129.71	*134.28*	*137.72*	*143.46*	*154.57*	*161.57*	*175.70*

Mean	Std Dev	Skewness	Kurtosis
134.06	14.863	1.1568	1.5942
Minimum		**Maximum**	
108.71		183.84	

41 ***Total Benefits, GCX 3, thous $ PV, MP 62.55***

	1%	5%	10%	20%	30%	40%
	335.26	*350.17*	*362.65*	*370.88*	*377.56*	*384.77*
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**
388.75	*402.11*	*414.89*	*431.85*	*459.79*	*482.38*	*524.36*

Mean	Std Dev	Skewness	Kurtosis
402.34	43.327	1.1512	1.5657
Minimum		**Maximum**	
329.95		547.00	

Result No.:	Result Variable Description	Percentile Summary	Summary Statistics

42 ***Total Benefits, GCX 4, thous $ PV, MP 71***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	455.88	*473.01*	*490.56*	*496.29*	*510.62*	*515.91*	542.34	58.617	1.3116	2.3194
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**	**Maximum**	
526.90	*538.29*	*559.48*	*575.23*	*620.22*	*641.05*	*716.74*		448.89	752.25	

43 ***Total Benefits, GCX 5, thous $ PV, MP 75.95***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	120.54	*125.91*	*130.32*	*132.50*	*134.96*	*137.23*	144.35	15.801	1.3055	2.3015
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**	**Maximum**	
139.49	*143.62*	*148.37*	*152.77*	*166.29*	*171.05*	*191.08*		118.51	200.87	

44 ***Total Costs, GCX 1, thous $ PV, MP 46.04***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	162.83	*162.83*	*162.83*	*162.83*	*162.83*	*162.83*	162.83	0.0	0.0	-3.0000
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**	**Maximum**	
162.83	*162.83*	*162.83*	*162.83*	*162.83*	*162.83*	*162.83*		162.83	162.83	

45 ***Total Costs, GCX 2, thous $ PV, MP 47.4***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	192.93	*192.93*	*192.93*	*192.93*	*192.93*	*192.93*	192.93	0.0	0.0	-3.0000
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**	**Maximum**	
192.93	*192.93*	*192.93*	*192.93*	*192.93*	*192.93*	*192.93*		192.93	192.93	

46 ***Total Costs, GCX 3, thous $ PV, MP 62.55***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	1,549	*1,549*	*1,549*	*1,549*	*1,549*	*1,549*	1,549	0.0	0.0	-3.0000
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**	**Maximum**	
1,549	*1,549*	*1,549*	*1,549*	*1,549*	*1,549*	*1,549*		1,549	1,549	

47 ***Total Costs, GCX 4, thous $ PV, MP 71***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	162.83	*162.83*	*162.83*	*162.83*	*162.83*	*162.83*	162.83	0.0	0.0	-3.0000
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**	**Maximum**	
162.83	*162.83*	*162.83*	*162.83*	*162.83*	*162.83*	*162.83*		162.83	162.83	

48 ***Total Costs, GCX 5, thous $ PV, MP 75.95***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	162.83	*162.83*	*162.83*	*162.83*	*162.83*	*162.83*	162.83	0.0	0.0	-3.0000
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**	**Maximum**	
162.83	*162.83*	*162.83*	*162.83*	*162.83*	*162.83*	*162.83*		162.83	162.83	

Result No.:	Result Variable Description	Percentile Summary						Summary Statistics			

49	***Decrease in pred. fatal acc., first year***										
	1%	***5%***	***10%***	***20%***	***30%***	***40%***	**Mean**	**Std Dev**	**Skewness**	**Kurtosis**
	.01787	*.01787*	*.01787*	*.01787*	*.01787*	*.01787*	.01787	0.0	0.0	-3.0000
50%	***60%***	***70%***	***80%***	***90%***	***95%***	***99%***		**Minimum**	**Maximum**	
.01787	*.01787*	*.01787*	*.01787*	*.01787*	*.01787*	*.01787*		.01787	.01787	
50	***Decrease in pred. fatal acc., last year near term***										
	1%	***5%***	***10%***	***20%***	***30%***	***40%***	**Mean**	**Std Dev**	**Skewness**	**Kurtosis**
	.01893	*.01896*	*.01904*	*.01906*	*.01911*	*.01912*	.01914	.00010	.08701	.38565
50%	***60%***	***70%***	***80%***	***90%***	***95%***	***99%***		**Minimum**	**Maximum**	
.01913	*.01915*	*.01917*	*.01920*	*.01926*	*.01931*	*.01935*		.01892	.01936	
51	***Decrease in pred. fatal acc., last year***										
	1%	***5%***	***10%***	***20%***	***30%***	***40%***	**Mean**	**Std Dev**	**Skewness**	**Kurtosis**
	.02080	*.02107*	*.02135*	*.02170*	*.02195*	*.02225*	.02234	.00076	.02562	.07527
50%	***60%***	***70%***	***80%***	***90%***	***95%***	***99%***		**Minimum**	**Maximum**	
.02237	*.02257*	*.02273*	*.02294*	*.02310*	*.02346*	*.02406*		.02071	.02428	
52	***Decrease in pred. injury acc., first year***										
	1%	***5%***	***10%***	***20%***	***30%***	***40%***	**Mean**	**Std Dev**	**Skewness**	**Kurtosis**
	.02306	*.02306*	*.02306*	*.02306*	*.02306*	*.02306*	.02306	0.0	0.0	-3.0000
50%	***60%***	***70%***	***80%***	***90%***	***95%***	***99%***		**Minimum**	**Maximum**	
.02306	*.02306*	*.02306*	*.02306*	*.02306*	*.02306*	*.02306*		.02306	.02306	
53	***Decrease in pred. injury acc., last year near term***										
	1%	***5%***	***10%***	***20%***	***30%***	***40%***	**Mean**	**Std Dev**	**Skewness**	**Kurtosis**
	.02414	*.02416*	*.02421*	*.02427*	*.02430*	*.02432*	.02434	.00010	-.00059	.11430
50%	***60%***	***70%***	***80%***	***90%***	***95%***	***99%***		**Minimum**	**Maximum**	
.02433	*.02435*	*.02437*	*.02441*	*.02445*	*.02451*	*.02454*		.02414	.02454	
54	***Decrease in pred. injury acc., last year***										
	1%	***5%***	***10%***	***20%***	***30%***	***40%***	**Mean**	**Std Dev**	**Skewness**	**Kurtosis**
	.02607	*.02622*	*.02649*	*.02676*	*.02696*	*.02725*	.02739	.00075	.67659	1.5920
50%	***60%***	***70%***	***80%***	***90%***	***95%***	***99%***		**Minimum**	**Maximum**	
.02738	*.02758*	*.02781*	*.02790*	*.02810*	*.02848*	*.02947*		.02601	.02995	
55	***Decrease in pred. PDO acc., first year***										
	1%	***5%***	***10%***	***20%***	***30%***	***40%***	**Mean**	**Std Dev**	**Skewness**	**Kurtosis**
	.02959	*.02959*	*.02959*	*.02959*	*.02959*	*.02959*	.02959	0.0	0.0	-3.0000
50%	***60%***	***70%***	***80%***	***90%***	***95%***	***99%***		**Minimum**	**Maximum**	
.02959	*.02959*	*.02959*	*.02959*	*.02959*	*.02959*	*.02959*		.02959	.02959	

Result No.:	Result Variable Description	Percentile Summary							Summary Statistics		

56 *Decrease in pred. PDO acc., last year near term*

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	.03107	.03109	.03118	.03125	.03129	.03132	.03134	.00013	.01830	.15693
50%	60%	70%	80%	90%	95%	99%	Minimum		Maximum	
.03134	.03136	.03139	.03143	.03149	.03157	.03162	.03107		.03163	

57 *Decrease in pred. PDO acc., last year*

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	.03371	.03394	.03433	.03469	.03496	.03539	.03556	.00103	.56951	1.2765
50%	60%	70%	80%	90%	95%	99%	Minimum		Maximum	
.03556	.03586	.03614	.03624	.03654	.03707	.03835	.03362		.03896	

58 *Decrease in delay auto, first year, veh-hours*

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	8.9391	8.9429	8.9520	8.9767	8.9837	8.9917	8.9993	.03292	.08376	-.38300
50%	60%	70%	80%	90%	95%	99%	Minimum		Maximum	
8.9956	9.0078	9.0151	9.0295	9.0381	9.0499	9.0708	8.9386		9.0726	

59 *Decrease in delay auto, last year near term, veh-hours*

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	11.829	11.950	12.176	12.269	12.381	12.429	12.509	.32190	.16796	.39487
50%	60%	70%	80%	90%	95%	99%	Minimum		Maximum	
12.480	12.563	12.628	12.787	12.916	13.069	13.261	11.742		13.282	

60 *Decrease in delay auto, last year, veh-hours*

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	18.675	19.953	21.274	23.222	24.563	26.026	26.920	4.5228	.41090	.54997
50%	60%	70%	80%	90%	95%	99%	Minimum		Maximum	
26.895	28.037	29.038	30.584	31.370	33.972	38.411	18.276		39.909	

61 *Decrease in delay trucks, first year, veh-hours*

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	3.3737	3.3751	3.3786	3.3879	3.3905	3.3936	3.3964	.01243	.08378	-.38301
50%	60%	70%	80%	90%	95%	99%	Minimum		Maximum	
3.3950	3.3996	3.4024	3.4078	3.4111	3.4155	3.4234	3.3735		3.4241	

62 *Decrease in delay trucks, last year near term, veh-hours*

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	4.4645	4.5100	4.5954	4.6304	4.6728	4.6910	4.7211	.12149	.16795	.39487
50%	60%	70%	80%	90%	95%	99%	Minimum		Maximum	
4.7100	4.7415	4.7658	4.8261	4.8747	4.9325	5.0049	4.4316		5.0126	

Result No.:	Result Variable Description	Percentile Summary						Summary Statistics			

63 *Decrease in delay trucks, last year, veh-hours*

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	7.0480	7.5305	8.0291	8.7641	9.2702	9.8224	10.160	1.7069	.41090	.54997
50%	60%	70%	80%	90%	95%	99%		Minimum	Maximum	
10.151	10.581	10.959	11.543	11.839	12.821	14.497		6.8974	15.062	

64 *Decrease in delay buses, first year, veh-hours*

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0000
50%	60%	70%	80%	90%	95%	99%		Minimum	Maximum	
0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	

65 *Decrease in delay buses, last year near term, veh-hours*

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0000
50%	60%	70%	80%	90%	95%	99%		Minimum	Maximum	
0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	

66 *Decrease in delay buses, last year, veh-hours*

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-3.0000
50%	60%	70%	80%	90%	95%	99%		Minimum	Maximum	
0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	

67 *Decrease in gas consumption, first year, gal*

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	5.7169	5.7193	5.7252	5.7410	5.7454	5.7505	5.7554	.02106	.08373	-.38302
50%	60%	70%	80%	90%	95%	99%		Minimum	Maximum	
5.7530	5.7608	5.7655	5.7747	5.7802	5.7878	5.8011		5.7166	5.8023	

68 *Decrease in gas consumption, last year near term, gal*

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	7.5653	7.6424	7.7872	7.8465	7.9182	7.9491	8.0002	.20587	.16795	.39487
50%	60%	70%	80%	90%	95%	99%		Minimum	Maximum	
7.9814	8.0348	8.0760	8.1780	8.2604	8.3583	8.4810		7.5096	8.4941	

69 *Decrease in gas consumption, last year, gal*

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	11.943	12.761	13.606	14.851	15.709	16.645	17.217	2.8925	.41090	.54997
50%	60%	70%	80%	90%	95%	99%		Minimum	Maximum	
17.201	17.931	18.571	19.559	20.062	21.727	24.565		11.688	25.523	

Result No.:	Result Variable Description	Percentile Summary	Summary Statistics

70 ***Decrease in diesel consumption, first year, gal***

50%	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	4.6025	4.6044	4.6091	4.6218	4.6254	4.6296	4.6335	.01695	.08376	-.38300
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**	**Maximum**	
4.6316	4.6378	4.6416	4.6490	4.6534	4.6595	4.6703		4.6022	4.6712	

71 ***Decrease in diesel consumption, last year near term, gal***

50%	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	6.0905	6.1526	6.2692	6.3169	6.3747	6.3995	6.4407	.16574	.16796	.39487
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**	**Maximum**	
6.4255	6.4685	6.5017	6.5839	6.6502	6.7290	6.8277		6.0457	6.8383	

72 ***Decrease in diesel consumption, last year, gal***

50%	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	9.6150	10.273	10.953	11.956	12.647	13.400	13.860	2.3287	.41090	.54997
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**	**Maximum**	
13.848	14.435	14.951	15.747	16.151	17.491	19.777		9.4096	20.548	

73 ***Decrease in oil consumption, first year, gal***

50%	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	.66666	.66694	.66762	.66946	.66999	.67058	.67115	.00246	.08377	-.38303
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**	**Maximum**	
.67087	.67178	.67233	.67340	.67404	.67492	.67648		.66662	.67662	

74 ***Decrease in oil consumption, last year near term, gal***

50%	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	.88220	.89120	.90808	.91499	.92336	.92696	.93292	.02401	.16796	.39487
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**	**Maximum**	
.93072	.93695	.94175	.95366	.96326	.97468	.98898		.87571	.99052	

75 ***Decrease in oil consumption, last year, gal***

50%	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	1.3927	1.4881	1.5866	1.7318	1.8318	1.9410	2.0077	.33730	.41090	.54997
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**	**Maximum**	
2.0058	2.0909	2.1656	2.2809	2.3395	2.5336	2.8646		1.3630	2.9763	

76 ***Decrease in CO emissions, first year, kg***

50%	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	3.5674	3.5689	3.5726	3.5824	3.5852	3.5884	3.5914	.01314	.08374	-.38302
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**	**Maximum**	
3.5900	3.5948	3.5978	3.6035	3.6069	3.6116	3.6200		3.5672	3.6207	

Result No.:	Result Variable Description	Percentile Summary	Summary Statistics

77 ***Decrease in CO emissions, last year near term, kg***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	4.7208	4.7690	4.8593	4.8963	4.9411	4.9603	4.9922	.12847	.16796	.39487
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
4.9804	5.0138	5.0395	5.1032	5.1546	5.2157	5.2922		4.6861		5.3004

78 ***Decrease in CO emissions, last year, kg***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	7.4526	7.9629	8.4901	9.2672	9.8024	10.386	10.743	1.8050	.41090	.54997
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
10.733	11.189	11.589	12.205	12.519	13.558	15.329		7.2935		15.927

79 ***Decrease in HC emissions, first year, kg***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	.23574	.23583	.23608	.23673	.23691	.23712	.23732	.00087	.08377	-.38302
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
.23723	.23755	.23774	.23812	.23835	.23866	.23921		.23572		.23926

80 ***Decrease in HC emissions, last year near term, kg***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	.31195	.31513	.32110	.32355	.32651	.32778	.32989	.00849	.16795	.39486
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
.32911	.33131	.33301	.33722	.34062	.34465	.34971		.30966		.35025

81 ***Decrease in HC emissions, last year, kg***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	.49247	.52619	.56103	.61238	.64775	.68634	.70992	.11927	.41090	.54997
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
.70926	.73936	.76578	.80653	.82726	.89589	1.0129		.48195		1.0524

82 ***Decrease in NOx emissions, first year, kg***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	.11534	.11539	.11550	.11582	.11591	.11602	.11611	.00042	.08373	-.38303
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
.11607	.11622	.11632	.11650	.11661	.11677	.11704		.11533		.11706

83 ***Decrease in NOx emissions, last year near term, kg***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	.15263	.15418	.15711	.15830	.15975	.16037	.16140	.00415	.16796	.39486
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
.16102	.16210	.16293	.16499	.16665	.16863	.17110		.15151		.17137

Result No.:	Result Variable Description						Percentile Summary			Summary Statistics	

84 ***Decrease in NOx emissions, last year, kg***

	1%	5%	10%	20%	30%	40%	Mean	Std Dev	Skewness	Kurtosis
	.24095	*.25745*	*.27449*	*.29962*	*.31692*	*.33580*	.34734	.05836	.41091	.54997
50%	**60%**	**70%**	**80%**	**90%**	**95%**	**99%**		**Minimum**		**Maximum**
.34702	*.36175*	*.37467*	*.39461*	*.40475*	*.43833*	*.49560*		.23580		.51492